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CONTENTS.

An Asterisk (*) denotes an illustrated article.

Central New York Gas Engineers Association..... 177
American Gas Light Association..... 177

EDITORIALS—

The Pittsburgh Meeting..... 177
Fatal Accident Caused by Electricity..... 178
The Petroleum Outlook..... 178
Electric Units..... 178
*Grimstons New Gas Burner..... 180
*Development of Lighting Power of Coal Gas, with Notes on Street and Interior Lighting..... 181
An Ancient Gas Engine..... 185
Electric Lighting at Troy, N. Y..... 186
Some of the Advantages of Using Dry Center Valves..... 186
A Gas Driven Refrigerator..... 187
The Edison System..... 188
October Quotations for Leading New York Gas Stocks for the Last Five Years..... 188
Exhibition of Gas and Electricity at the Crystal Palace..... 188
Patents..... 189

[OFFICIAL NOTICE.]

Central New York Gas Engineers Association.

OFFICE OF CENTRAL N. Y. GAS ENGINEERS' ASSOCIATION,
Sept. 15th, 1882.

On account of the Meeting of the American Gas Light Association occurring upon the day set apart for the semi-annual meeting of the Central New York Gas Engineers Association, the members of the latter Association are earnestly requested to be present at the American Association meeting at Pittsburgh, where final arrangements for a session will be arranged.

CLEM. A. WHITE, *Secretary.* JOHN MCDOUGALL, *President.*

[OFFICIAL NOTICE.]

American Gas Light Association.

OFFICE AMERICAN GAS LIGHT ASSOCIATION,
No. 142 CHAMBERS ST., N. Y.

The Tenth Annual Meeting of the Association will be held in the city of Pittsburgh, Pa., on the 18th, 19th and 20th days of October. The first session commencing at 10 o'clock on the morning of the 18th.

Headquarters will be at the Monongahela House, where the sessions of the Association will be held. Special rates of board, three dollars per day, have been arranged for members and their ladies. Under charge of the Committee of Arrangements, Friday, October 20th, will be devoted to visiting objects of interest in the city, a trip to the mines of the Westmoreland Gas Coal Company, and to the usual hospitalities of the local gas companies.

Ladies who may accompany members will be cared for during the sessions of the Association by a committee, who will accompany them to various places of public interest in the city.

Members who intend to present papers are again respectfully urged to promptly notify the Secretary of the fact, as also of the subject selected, so that the Executive Committee may complete its programme, and all be enabled to secure proper presentation and discussion of their papers.

Any officer of a gas company, person skilled in gas manufacture or industries connected therewith, is qualified for membership in the Association, and can obtain blank forms of application by applying to this office.

WM. HENRY WHITE, *Secretary.*

THE PITTSBURGH MEETING.

It is to be supposed that sufficient publicity has already been given to announcing the meeting of the American Gas Light Association, which is to take place at Pittsburgh, Pa., on the days named in the official notice of the Secretary. We regret that we are unable to present in advance all the details of the programme prepared.

The first and second days of the session will be devoted strictly to the business proper of the Convention, and the 20th will be devoted to sight seeing, and the excursion to the mines of the Westmoreland Coal Company, winding up the day with the usual banquet.

At this time of writing it would seem that the meeting will be very largely attended, and that the proceedings will be of unusual interest. We have already pointed out time and again the advantages to be derived from meetings similar to these, and look forward to the results of the coming meeting as a confirmation that our opinions have not been without influence. Papers of considerable interest have been prepared upon subjects which should evoke full and free discussion.

The headquarters of the Association will be at the Monongahela House, and it is to be presumed, to prevent any personal discomfort, that those intending to be present have already notified the Committee of Arrangements so that suitable accommodation may be afforded them, although it is not likely that the Monongahela House host will find great trouble in making everyone comfortable.

Our report of the proceedings will be commenced in the next issue of the JOURNAL.

Fatal Accident Caused by Electricity.

A workman in the employ of the Brush Electric Lighting Company of this city, named Joseph Staman, was recently killed by an electric shock received while transferring some electric light wires from one pole to another. Contrary to orders he removed the coverings of both the electric light wires on the cross-arm where he worked before attaching the ends of a section to either wire. His body at once formed a connection between the positive and negative wires.

Frederick Layman, the assistant foreman, noticed Staman hanging from the two wires, each firmly clasped. His body was swaying to and fro in the air, while his features were drawn out of shape by the agony he was enduring. An alarm was given and other linemen were sent up the telegraph pole. They first cut the wires to prevent further harm. Then they lowered Staman to the street; he was still alive but insensible. He was carried to the Elizabeth street police station, where he died in about fifteen minutes. The only visible effect of the electric current on Staman's body was on the palms of his hands; there the skin had been burned away and the flesh was blackened. Staman was thirty-one years old and was married.

The Petroleum Outlook.

Since our last issue a change of considerable importance has come over the situation in the oil regions. The Cherry Grove district, in Warren county, has from all appearances, reached its highest production; and within the past three weeks has shown a decline which is variously estimated at from ten to twenty thousand barrels, in daily yield. In the middle part of this field, which was regarded as the richest part, a number of wells have stopped producing altogether, while many of the others have declined to less than a hundred barrels each per day. Salt water has made its appearance in this part of the field; the gas too seems to have become nearly exhausted, and the sand being loose, the wells here are considered difficult to manage as pumping wells. In the northern part of the field, however, the gas seems to be more plentiful; the salt water has not yet appeared, consequently the wells exhibit a steadier yield. Several of the new wells, which have come in on the north-eastern edge, prove that there is considerable vitality to this section yet.

In the southern extremity of the field, as at present bounded, the wells came in smaller from the beginning, and have not shown anything like the decline which marks the middle of the field; they seem to hold up fairly as moderate producers, from fifty to one hundred and fifty barrels per day each. On the lots south-west of the present development, there are two wells, which are nearing the sand, and which are regarded by the trade with a good deal of interest, as tending to settle the question whether the producing area extends southward beyond the present defined lines.

The Grandin well, some miles southwest of Cherry Grove, a little east of the 45 degree line, has attracted attention on account of its location. It reached the "Cherry Grove sand" some weeks ago, and was shut down by its owners awaiting pipe line facilities. Since it was shut down it has flowed continuously through the casing at the rate of fifty barrels per day. This well will probably be opened up within a few days. The general opinion is that it will not be over a hundred barrel well.

The Shannon well, on the Cooper Tract, in Forest county, which has been held as a mystery for several months past, was opened on the 10th ult., and flowed about one hundred and sixty barrels the first twenty-four hours, since which it has settled down to an eighty barrel well.

In the Bradford and Richburg fields the production has undergone a gradual and not very significant decline. Until the past two weeks, there have been comparatively few new wells begun in these fields, but the decline in the Cherry Grove district is now considerably stimulating new ventures, particularly in the Richburg field.

The late advance in the crude market, has rather led the public to accept exaggerated reports of decline in the production, and at the same time it has tended to charge the over-active producer with hope, and it has thus induced and is inducing too much new drilling. It ought to be remembered that even with the estimate of the most sanguine believers in the decline of the Cherry Grove production, we yet have a large margin of excessive production, which will be likely to continue for a considerable period of time, before consumption grows sufficiently to overcome it. In other words we will be likely to continue to add to our stocks (as we have added to them for the past five years) for some time to come. During last month we made an addition of over a million of barrels.

The stock of refined in Europe is still large, as compared with that stock at the same time last year. The slowness with which European quotations follow our late advance in crude, and the apparent tardiness with which the exporter is now taking oil, rather plainly indicates the present indifference and independence of Europe on the oil question.

Taking the crude and refined situation altogether, and including with it the prevailing stringency in the money markets of the country, we believe the conservative corollary to be that a large and permanent advance in prices is not to be expected in the near future.—*Petroleum Reporter.*

Electric Units.

We give below a translation of a paper read before the Association for the Study of Electricity in Paris. To those who are really interested in the science of electricity, and who desire to become familiar with its fundamental principles and expressions, we commend this paper as being the simplest and most intelligible explanation of a subject which has hitherto been shrouded in a good deal of indistinctness and indefiniteness. The nomenclature, equations, etc., given here are those now adopted by scientific men, and are as generally accepted as the symbols in chemistry.

The Measure of Electric Magnitudes, or Values of Electric Units.

By D. Monnier, C.E.

The numerical value of a concrete quantity indicates the proportion which exists between it and a quantity of the same nature, which is assumed as *Unity*. If the letter L represents one given length, and small l another, which it is convenient to assume as *unity*, then the proportion $\frac{L}{l}$ is what is called the numerical value of L.

We see at once that the numerical value of any given quantity varies in inverse proportion to the unit which has been chosen to serve as the measure of it. Thus the number which expresses a given length in centimeters is one hundred times as great as the number which expresses the same length in meters.

Aside from the fact that the unit must be a quantity of the same nature as that which we wish to compare with it, its magnitude may be assumed arbitrarily, and the great number and variety of measures in use for defining quantities of the same kind need not surprise us. But as scientific, industrial and commercial relations are developed, the inconveniences of this multiplicity are quickly recognized, among the least of which may be the neeessity for long and tedious calculations every time that it becomes necessary to compare quantities of the same kind which may be expressed in dissimilar units. The conception of the metric system of weights and measures has been a point of departure towards a rational simplification of units, because it constitutes a coherent whole in which the units of surface, of volume, and of weights are logically deduced from the unit of length.

The diversity which has so long existed, and which still exists in ordinary measures, presents itself in the same way in the units adopted by the first or earlier electricians.

So long as their researches had for their object only the study of general laws, this diversity was not attended with any great inconvenience; but the moment the application was to be made to industrial pursuits, the necessity became at once apparent to choose units that should be clearly defined, and such that their employment could be generalized. In England, at the time the great submarine cable enterprises were being carried out, the success of which depended in a great degree upon the precision with which electrometric determinations could be made, this problem presented itself with great force, and in 1861 the British Association for the Advancement of Science established a special commission for the study of this question of electric measurements.

The system of units proposed by the British Association received the official sanction of the International Congress of Electricians, held at Paris, in 1881, and forms the basis of electro-measurement, or, as it is termed, "electrometrie."

Before proceeding to explain the units adopted by the Congress, I deem it to be useful to explain as briefly as possible the principal magnitudes which these units serve as measures. They are "Quantity," "Difference of Potential," "Electromotive Force," "Capacity," "Current," and "Resistance."

Quantity.

When one body has the property of attracting light bodies placed near it, we say that it is "electrified."

Experiment has taught us that two electric states exist to which the names of vitreous and resinous electrization have been given. These two states may be considered as being the consequence one of the other, in the same way as reaction is the consequence of action, for we can produce an electrization, either vitreous or resinous, without developing at the same time an electrization of the opposite name, whose action is equal and opposite to the first. "Action and reaction are equal, simultaneous and contrary."

Each of these electric states is defined by the action which it exercises upon other electrified bodies, and it appears that, for purposes of calculation, an increase or diminution of electrization may be considered as resulting from

the addition or subtraction of something which it is convenient to call electricity. The existence of this quantity of electricity, or this electric charge, being rendered perceptible by the action that it exercises upon other similar quantities of a quantity, A, of electricity exercises a force which is double that exercised by a quantity, B, placed under the same conditions. We say that the quantity A is double the quantity B in the same way that we say that one quantity of water is double that of another, if its weight is double, or if it exercises a force double that exercised by the first.

"*Quantity*" *of electricity may then be defined by the force which it exercises upon other similar quantities.* Quantity is designated by the letter Q.

Potential.

If we take two bodies whose electric states are different and unite them by a conductor, at the end of a very short time the two bodies will assume the same state (or be in electric equilibrium) which will be the resultant of the two primitive states—just in the same way as if we connect two vessels of water, which are at different levels, by a conduit, the water will run from the higher to the lower level until the water stands at the same level in the two vessels. This difference in the (original) electric state of the two bodies has received the name of "*Difference of Potential.*"

The water in passing from the higher level, A, to the lower level, B, performs a certain amount of *work* which is measured by the weight of water displaced multiplied by the difference in level.

In the same way a quantity of electricity, Q, in passing from A to B, will develop a certain amount of work expressed by the product of Q by the difference of electric level, or the fall of potential.

We can then say that the difference in potential of the points A and B has for its measure the work performed by a unit of electricity in passing from the point A to the point B, in the direction in which it naturally tends to move, in the same way as we would say that the difference of level of two material points, A and B, has for its measure the number of kilogrammeters that would be developed by the fall of one kilogrammeter passing from A to B.

If the point A is at a higher level than B the work will be positive—that is to say, it could be utilized under the form of exterior work. In the contrary case (if B is higher than A) it would be negative—*i.e.*, it would be necessary to employ exterior work to cause the positive unit of electricity, or the kilogramme, to pass from A to B.

A difference of potential, like a difference of level, indicates a relative condition between two points, and there is no single point of which the potential has an absolute value. It is only by abbreviation that we speak of the potential of a point to express the difference which exists between the potential of that point and that of the earth taken as a relative zero—just as we speak of the height of an edifice.

The absolute zero of potential exists only in infinity, and is a mathematical abstraction.

The difference of potential of two points is expressed by the notation $V_A - V_B$, and the difference of potential between any point whatever and that of the earth is expressed by V.

Capacity.

If an isolated conductive body is put in communication with a source of electricity it becomes charged with electricity just at the moment when the equilibrium of potentials is established.

Experiment shows that the quantity of electricity necessary to produce this equilibrium in a given conductor, is proportional to the difference of potential which exists between it and the neighboring conductors, and "electric capacity" of a conductor is the name given to that charge which it is necessary to give the conductor in order that its potential may be increased by one unit. In the same way we say the capacity of a body for heat is measured by the quantity of heat necessary to raise its temperature one degree. Electric capacity is designated by the letter K; and, according to the definition given above, $K=\frac{Q}{V}$, or $Q=KV$.

Current.

We have seen that if two isolated conductors, with different potentials, are united by a conductor, in a very short time they will have the same potential. We consider this final state of equilibrium as resulting from the transfer of electricity from one body to the other. This transfer, or "rush," of electricity, which we call the "electric current," always takes place when one conductor is used to unite the other conductors whose potentials are different.

We give the name of "electromotive force" to the cause, whatever it may be, which tends to produce a displacement of electricity. Whenever there is a difference of potential there is electromotive force; but there is also electromotive force in cases where electricity moves from one point to another, without there being a difference of potential between these points. To explain this—let us conceive of two reservoirs of water, A and B, at the same level, connected by an open conduit or pipe, through which a cord or rope passes.

If we pull the rope rapidly from A towards B the water will be drawn along with it mechanically, and we shall find the level of the water in B raised above that in A just in proportion to the amount of water which the rope displaces by its mechanical action. The current of water produced in this case is not the result of a difference of level, and this difference of level, so produced by the pulling of the rope, is designated by a sign contrary to that which would have been used to designate a natural current from A to B. Experiment indicates that we can in the same way induce a displacement of electricity in an open conductor by exterior work, and that the result of this work is to create a difference of potential between the two extremities of the conductor with a sign contrary to that which would have been due to the observed current. The designation "electromotive force" has then a more general significance than the "difference of potential." Electromotive force is designated by the letter E.

The existence of a displacement of electricity, or of an electric current, is rendered perceptible by certain new properties which the conducting wire acquires during the duration of the phenomenon, and, among others, is that of deviating a magnetic needle; and we can prove by experiment that the force which produces this deviation is proportional to the quantity of electricity which passes in one second.

We thus come to define the current by the quantity of electricity passing in one second. This definition is expressed by the equation $C=\frac{Q}{T}$, or $Q=CT$, in which C=current; Q=quantity; and T=time.

Resistance.

We know that different bodies conduct electricity more or less readily; and we say that an imperfect conductor opposes a resistance to the passage of electricity. This is true of all known bodies; or, in other words, that whatever may be the conductor by which two bodies, of different potentials, charged with electricity, are united, a certain amount of time is necessary to establish the equilibrium. The quantity of electricity which passes between two points, whose difference of potential is maintained constant, depends upon the resistance of the conductor which joins the two points.

Experiment shows that if, in the production of a current, we modify the electromotive force, without in any manner changing the other elements, the current will always vary proportionately to the electromotive force, so that, for any given conductor, we should always have, $\frac{E}{C}$=Constant. This constant is what we call the "electric resistance" of the conductor, and we represent it by the letter R. The law expressed above can be designated by one of the three equations, $R=\frac{E}{C}$, or $C=\frac{E}{R}$, or $CR=E$. This is the law of Ohm. Experiment has demonstrated that the resistance, R, of any homogeneous conductor of a cross section is directly proportional to its length, and inversely proportional to its transverse section whatever may be the form of that section.

This resistance varies considerably between one body and another, and also for the same body under different conditions. It varies, within limits more or less extended, with the purity, the molecular condition, and the temperature of the body.

The "*specific resistance*" of a body is the resistance at 0° (zero, Centigrade) of a conductor formed with this body having a length and cross section of unity.

Experiment has shown us that a quantity of electricity, Q, in passing from a higher electric level to a lower one develops work which is manifested either by mechanical, chemical, or calorific action. The effects produced by currents can then be expressed in functions of the work which they are capable of developing. Dr. Joule demonstrated experimentally that when a current traverses a conductor, the quantity of heat disengaged, *i.e.*, the work produced in a given time could be measured by the product, C^2Rt.

This experimental result is a demonstration of the relation $W=QE$, which is deduced from the definition of electromotive force (W being the work), so that, by definition, we have—

(1) $Q=Ct$.
(2) $CR=E$.
(3) $W=C^2Rt$.

If to these three equations we add the relation—

(4) $Q=KE$

which defines capacity, we shall have the four fundamental equations which bind together the five principal electric magnitudes—: Quantity, Q; Current, C; Resistance, R; Electromotive Force, E; Capacity, K.

As there are four equations, and five quantities, by fixing arbitrarily the value of one of the quantities, the others may be deduced.

[To be continued.]

Grimston's New Gas Burner.

[The *Journal of Gas Lighting* of September 5th contains an illustrated description of the improved burner devised and patented by Mr. Grimston, which we here reproduce. The importance of producing a burner which will give the ordinary domestic user the full illuminating value of the gas consumed would seem to be of great moment; and this is the object sought to be obtained by the invention of Mr. Grimston.]

Speaking at the last meeting of the Gas Light and Coke Company, Mr. George Livesey said many things with a view to inspire confidence of the future in the minds of timid gas proprietors. Among others he mentioned the advances now being made by inventions with regard to improved appliances for developing the illuminating power of coal gas, with especial reference to a new burner just patented by Mr. Grimston. Mr. Livesey passed a very high encomium upon the burner, and this expression of opinion by such an authority is sufficient to arouse deep interest in the apparatus in question. It is therefore with much pleasure that we present our readers with the following early account of Mr. Grimston's burner, for which we are indebted to the inventor and Mr. George Bower, of St. Neots, in whose manufactory the burners are now being made in all sizes.

It should be premised, to save disappointment, that the invention is yet so fresh that its ultimate capabilities are unknown. The accompanying illustration therefore represents the bare skeleton of one of the first models; and the actual performance of only the very earliest burner, made in great part by Mr. Grimston himself, has been fully tested. Before proceeding to describe the invention, a brief history may be interesting of how it happened that Mr. Grimston, an electric lighting engineer, became a gas burner maker. The story will undoubtedly help to explain the reasons for many of the characteristics of the new burner.

It appears, then, that Mr. Grimston, who was connected with the electrical engineering establishment of Siemens Bros. & Co., Limited, was some months ago shown the construction and working of the Siemens regenerative gas burner, which is now sufficiently well known to render a description unnecessary here. In common with most spectators of this very ingeniously and philosophically designed appliance, Mr. Grimston was struck with its bulk, and the superficial clumsiness of the arrangement whereby the air and gas supply are heated in it by the products of combustion. These lamps have, of course, been materially improved of late; but when Mr. Grimston first saw them, perhaps 18 months ago, they certainly could not be called neat and compact in design. He at once grasped the idea embodied in these lamps, and set about constructing an arrangement which should be based on a similar principle, but at the same time avoid the inconveniences complained of. It is not too much to say that he has succeeded in both these aims, and the burner which now bears his name strikes the observer at once by the brilliant light which it produces by the simplest and most obvious means. We may now describe, by reference to the accompanying illustrations, how Mr. Grimston produces the regenerative effect which is likewise the central idea of the Siemens burner.

The light is simply that produced by an arrangement of a kind of Argand burner turned upside down. The central gas pipe *a* (figs. 1 and 3) is connected to a distributing chamber, whence the annular cluster of brass tubes *a' a'* (figs. 1 and 2) are prolonged downwards, forming the burner. The burner is enclosed in an iron or brass annular casing *b b*, which forms the main framework of the apparatus. The annular space which it affords is the outlet chimney or flue for the products of combustion of the burner beneath, and is crossed by a number of thin brass tubes *c c*, which lead from the outer air into the inner space containing the burner tubes *a' a'* already described. The upper openings of the annular body *b* are shown at *e e* (fig. 3), which communicate direct with the chimney proper *e' e'*. The burner is lighted by opening the hinged glass cover *d*, which fits practically air-tight on the bottom of the body, so that the air needed to support combustion must all pass through the tubes *c c*, the outer ends of which are protected by the casing *k k*.

When the gas is lighted at the burner, and the glass closed, the burner begins to act at once, although some minutes are necessarily required to elapse before its full brilliancy is gained. The cold air passes in through the tubes provided for it, and when these are heated to the fullest extent on their outside, by the hot fumes from the burner, they so readily part with their heat to the air that a temperature of 1,000° to 1,200° F. is easily obtained in the air when it arrives inside, and commences in turn to heat the burner tubes. The air tubes are placed so as to intercept the hot gases as completely as possible; and also, of course, obtain heat by conduction from the sides of the annular body. It is evident that the number and dimensions of these tubes might be increased so as to abstract almost all the heat from the escaping fumes, but for the limitations imposed, firstly, by a consideration of the actual quantity of air required to support combustion; and, secondly, by the obligation to let sufficient ascensional power remain in the gases which are left to pass out through the chimney. If the gases are cooled too much, they will either fall back into the lamp and extinguish the flame, or will be removable only by the draught of a long chimney. It will probably be the aim of the inventor to balance these requirements, and so to produce burners with very short or longer chimneys, accordingly as appearance is to be consulted, or the highest possible effect produced.

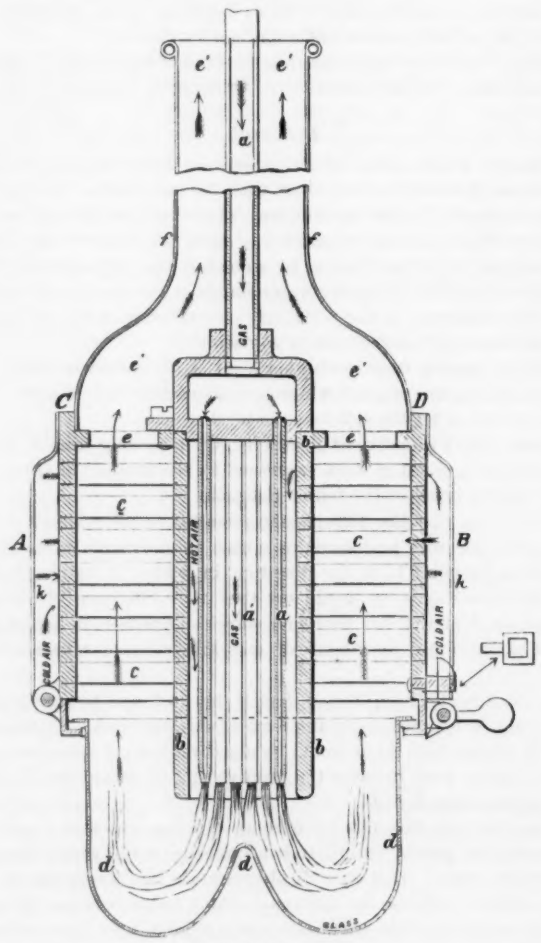

FIG. 1.—SECTIONAL ELEVATION.

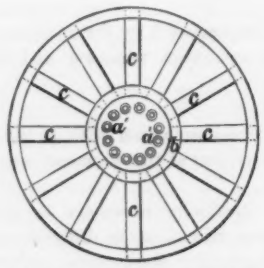

FIG. 2.—SECTION THROUGH AB.

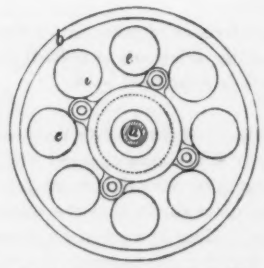

FIG. 3.—SECTION THROUGH CD.

The burner is a ring of brass tubes of considerable diameter, in proportion to the quantity of gas consumed, and thus provides for the delivery of gas expanded by heat. In connection with this device an explanation may be found of the failure of the British Association Committee on Gas Burners to find any advantage from previously heating the air and gas consumed. The Committee did not make the necessary provision for the increased bulk of the combustible and its air supply, caused by their heightened temperature; and the same quantity of gas measured cold (at the meter) could only be driven through the ordinary small burner holes at a velocity destructive of good results. Herr Frederick Siemens perceived this in his early experiments, and not only increased the orifices of his burners, but provided for the closer contact of the more rarefied gas and air by the use of notched deflectors, which are now an essential part of his apparatus. Mr. Grimston also uses separate tubes of large area for his hot gas, but dispensed with deflectors save in so far as the same duty may be performed by the plain lower edge of the inner cylinder of the lamp body, and the indentation of the glass beneath, which, as will be noticed, is made to follow the shape of the flame.

It only remains now to speak of the flame and its qualities. It is, in the first place, a flame of hot gas, burning at an extremely small velocity o-

flow, and wholly exposed to view from the exact point which it is required to light. In this latter respect it differs materially, and with advantage, from the Siemens burner, which, while presenting an extremely brilliant and beautiful ball of flame outside its central tube of porcelain, may yet be tailing smokily downwards inside this opaque screen, and thereby causing unperceived waste. The flame of the Grimston burner, on the other hand, is quite exposed, and all its light, from the ends of the burner tubes to the point where visible combustion ceases, is made available for use. As a perfect Argand flame in the usual position has been likened in form to a tulip flower, so this burner presents the appearance of an inverted convolvulus. So far as he has already gone, Mr. Grimston prefers to keep the tubes of the burner at such a distance from each other that the several jets part at the point where they turn upward, to that the convolvulus figure is not maintained to the edge of the flame.

From its peculiar position the light is, of course, completely shadowless as regards the lamp which affords it; and this of itself is no small recommendation for a pendant. It shows well for the simplicity and effectiveness of the perfected burners that Mr. Grimston's experimental example, although necessarily imperfect in many ways, burns with a remarkably steady light, of great brilliancy, which is assured by the fact that the products of combustion are robbed of all their heat to magnify their useful effect, so that the hand may be borne with ease over the outlet of the chimney.

With respect to the endurance of the apparatus, it will be sufficient to remark that there is nothing in the gas or air heating arrangements to get out of order, and they are all easily accessible while the burner is in action. The glass is not liable to breakage, although it is in close proximity to the flame, as may be gathered from the testimony of the inventor, who has never broken one, notwithstanding the severity of some of his experimental studies upon his first lamp.

The consumption of gas in the first working model burner made by Mr. Grimston was 10 cubic feet per hour, and its illuminating power averaged 60 candles. The diameter of this burner was 1¼ inches across the tubes. It is scarcely necessary to state that if this high duty, which was obtained with the ordinary 16-candle gas of the Gas Light and Coke Company, can be maintained, to say nothing of being exceeded, in the commercial article, the Grimston burner, with its other advantages over all existing methods of obtaining equal results, has a great future before it. For example, it does not require a separate air supply under high pressure, or any extra material to render incandescent, and it may be turned on full immediately upon lighting. It throws a shadowless light, and lends itself to ventilating arrangements; and it is not by any means cumbersome, delicate in construction, or costly in manufacture. One of the greatest advantages to which it lays claim is, however, the power of yielding almost as good results in a small burner as in a large one. This is a consideration of great moment, when it is remembered that the tendency of most of the high power burners hitherto introduced is to benefit the lighting of streets, large interiors, and, generally speaking, points of great consumption. Meanwhile the private user of burners consuming from 3 to 5 feet of gas per hour has been left to attain, as best he might, by the use of burners excellent of their kind, to the maximum effect of the standard Argand. Now, however, Mr. Grimston seeks to make the small consumer partake of the advantages erstwhile reserved for the wholesale user of large and costly Siemens and other lamps; and he even looks to this class of patrons with particular care.

The example which we now illustrate, in fig. 1, is a sectional presentment precisely half the actual size of a 5-feet burner, which it is intended to prepare for the market before all others. Another simple form of the burner, with vertical tubes, will, we understand, be introduced as soon as possible. It will be readily understood that the principle is capable of being embodied in many shapes; and it is satisfactory to learn that the inventor is quite alive to the necessity of producing a cheap as well as a good burner.

Gas companies, as Mr. Livesey has expressed it, will be well content with a slower relative growth of consumption, if their consumers are at the same time making their gas go as far again as formerly, by the use of burners which turn nominal 16-candle gas into gas of 30-candle actual illuminating power. How far Mr. Grimston's invention may succeed in this work is not for us to say. It is sufficient for the present that he has done excellently well in showing how Herr Frederick Siemens's scientific principles of regenerative gas burner construction may be carried out in yet another way. There is nothing more common in industrial annals than for one man to begin a work which another is destined to bring to greater perfection. Whether this natural process is to be repeated in the present instance must be left for the future to decide. In any case, Mr. Grimston's success, if success is to be his reward, though it will be well merited by his ingenuity and perseverance in solving a difficult problem, will never cause us to forget the prior claims of Herr Frederick Siemens, of Dresden, to the palm of the discoverer.

Mr. Grimston may or may not be the happy inventor of the best gas burner of the day; but there is the consolation of knowing that in the same field in which he will find his recompense there is room for any number and variety of useful and much needed improvements of a like character and object.

Development of the Lighting Power of Coal Gas, with Notes on Street and Interior Lighting.

A paper read before the North British Association of Gas Managers by Mr. G. Bray, of Leeds, with the discussion thereon.

The electric light, whatever may be its ultimate effect on gas interests, has served the purpose of rousing the attention of those engaged in the gas industry to the possibilities of their position, and appears to have inspired them with a general determination not only to maintain their present "points of 'vantage," but, with vigorous steps, to make further advancement. That this progress may be substantial, it is necessary that it should be based upon sound principles; and if, in the past, wrong lines have been followed, it will, of course, be of advantage to all connected with gas, and likewise to the general community, that a new departure should be taken in the right direction.

In this paper it will be my endeavor to show that, with regard to the development of the lighting power of coal gas, a wrong theory had universally obtained, and to enunciate a correct one in its place. In doing this, publicity will be given to a matter, intimately associated with the success of my business, which has hitherto been kept to myself; but the time has come when correct information on a question of so much importance should be made known, for the benefit of the industry with which we are all connected.

The prevailing theory has been that, in order to develop to its utmost lighting power, gas must be consumed at the minimum of pressure at the point of ignition. Instances of the promulgation of this theory abound in papers read before the several gas and other influential associations, and in evidence given in courts of law and before parliamentary committees; and as full accounts of these have been published in our trade and other journals, there is no necessity to give quotations in proof of its prevalence. But I am confronted with this initial difficulty, that the amount of pressure meant by the "minimum of pressure" has never been defined; but a general idea of what is understood by it may be gathered from such quotations as these—viz., the gas should be consumed "without pressure," at "the lowest possible pressure," and "pressure at the point of ignition decreases the illuminating power." The theory, as thus expressed, has been applied to flat-flame and Argand burners alike, and the above forms of expression have been repeated as if they were axiomatic.

In dealing with this theory I shall endeavor to show: Firstly, that the leading functions performed by pressure in Argand burners and flat-flame burners are opposed to each other, and that consequently no theory based upon the identical operation of pressure in both classes of burners can be a guide for the development of their lighting power. Secondly, that the successive developments of the lighting power of neither class of burners have been accomplished under the condition of a minimum of pressure. Thirdly, that as the lighting power of gas per foot consumed is increased by flat-flame burners, there is (all other things being equal) an increase of pressure. And in the fourth place I shall lay down what I consider the right principle applicable to both classes of burners for the development of their lighting power.

To prove my first proposition as to the diverse functions performed by pressure in the two classes of burners, and its consequent unreliableness as a guide, let us consider its operation when a flat-flame burner is used. In this burner pressure has to perform the essential duties of spreading and giving stability to the flame, and of keeping up the temperature by accelerating combustion, all of which it does by ejecting the gas into the atmosphere at a considerable speed. On the other hand, in the Argand burner pressure does not spread and give stability to the flame, nor accelerate combustion. Apply a light to the Argand burner when divested of its chimney, and there is a dull and rolling flame, the pressure being insufficint to give it brilliancy and stability; put on the chimney, and without any change of pressure the rapidly upward-moving columns of air make the flame bright, luminous, and steady. Thus in the case of the Argand burner the rapidly moving columns of air perform the same functions as in the flat-flame are effected by the rapid flow of the gas.

Now let us notice another opposite effect of pressure on the two flames, which is, as we shall see hereafter, vital in its import. Apply a light to each of the burners when only a small quantity of gas is turned on. Gradually turn on more gas, and you will see that as the pressure increases the flat-flame is thinned, whilst the Argand flame is thickened. In view of these different effects produced by pressure in the two classes of flames, I submit that no theory based on pressure can be a guide for the development of their lighting power.

We will now consider my second proposition, that the developments of the lighting power of neither class of burners have been accomplished under the

condition of a minimum of pressure. Let us light a flat-flame burner which will yield its best result with a consumption of, say, 5 feet of gas per hour. Now with "the lowest possible pressure" of gas there is only a small speck of blue flame at the top of the burner. Of course it would be absurd to say that this burner is now yielding its greatest amount of light for the gas consumed; but if the "minimum of pressure" theory were sound, such would be the case. If, however, this be not the minimum meant by those who advanced the theory, we will turn on more pressure until the burner is consuming, say, 2½ feet of gas per hour. Now, is this the minimum of pressure at which the burner yields its highest lighting power for the gas consumed? The reply, of course, is "No." Then let us put on more pressure, until a consumption of 5 feet per hour is reached; and this being the pressure at which the burner yields the greatest amount of light for the gas consumed, and seeing that we have been gradually increasing the pressure from the lowest possible up to the present point, would it not be as reasonable to say that this burner yields its best result at a maximum as at a minimum of pressure?

Again, let us test the minimum of pressure theory with an Argand burner. We will take a 5-feet Argand. In this case let us observe the results when the burner is consuming the quantity of gas per hour for which it is constructed—viz., 5 feet. With this consumption it will yield, say, 16 candles of light. Now, if the pressure be diminished—that is, if we leave the maximum pressure at which the burner is designed to work, and go in the direction of the minimum of pressure—shall we increase the lighting power for gas consumed? Certainly not; for, lower the pressure until the burner is consuming 2½ feet per hour, and the light yielded, instead of being at the rate of 16 candles per 5 feet of gas, is only at the rate of 10 candles. Lower the pressure further, and the lighting power for the gas consumed is still further reduced, thus showing that simply lowering the pressure in the Argand does not increase the lighting power, as it would do if the "minimum of pressure" theory were correct. But it may be said that if the pressure could be lowered, and the burner still made to pass its 5 feet per hour, then the lighting power might be increased. I reply that the holes for the emission of the gas, even in the best Argand burners, could be so enlarged that the requisite quantity would be passed at one-quarter the lowest pressure now employed. Yet this is not done. And I venture to say that Argand burners are not now constructed, and never were constructed, in accordance with the "minimum of pressure" theory.

My third proposition—that, as the lighting power of gas, per foot consumed, is increased by flat-flame burners, there is (all other things being equal) an increase of pressure—is illustrated by the accompanying extracts of tests made at the instance of the British Association for the Advancement of Science. It will be observed in Table I. that the best result for gas consumed by the No. 2 union jet is at 4-10ths pressure, which yields 18.7 candles per 5 feet of 16-candle gas. But when Nos. 6, 7, and 8 are reached, 4-10ths pressure ceases to yield the best result; a pressure of 9-10ths takes the first place, with a developement 28.6 candles per 5 feet of gas by the No. 8 burner. An examination of Tables II. and III., which contain tests with 16-candle gas, will further illustrate my proposition; and without submitting these as conclusively proving it, I put them forward as strong evidence in its favor, and feel sure that the more it is tested by further experiments, the more firmly will its correctness be established.

The above considerations, I maintain, prove that, whatever the principle may be by which the lighting power of coal gas is developed, the "minimum of pressure theory," instead of embodying it, is wholly unsound and misleading.

Let me now direct your attention to the principle which I hold to be correct. It is the one in accordance with which my improvements in the lighting power of burners for several years have been effected—notably the improvement effected in slit burners, early in 1879, whereby I increased the lighting power of 16-candle gas by 2.2 candles—and, further, all other improvements with which I am acquainted are explainable on this principle. My theory is that to develop the lighting power of coal gas the thickness of the flame must be adjusted to the quality of gas to be consumed; that for every quality of gas there is a thickness of flame which will yield the greatest amount of light for the gas consumed, and that the thickness required lessens as the lighting power of the gas increases.

For the production of the requisite thickness of flame the primary agent is the burner; but, as will have been gathered from the remarks on my first proposition, pressure of gas is also an impor-

TABLE I.—*Extracted from British Association Tests*, 1878.
Burner used—"Regulator" Union Jet, with 26-candle gas.

Kind of Burner.	At 4-10ths Inch Pressure at Point of Ignition.			At 9-10ths Inch Pressure at Point of Ignition.		
	Cubic Feet of Gas per Hour.	Illuminating Power.	Illuminating Power per Five Cubic Feet of Gas	Cubic Feet of Gas per Hour.	Illuminating Power.	Illuminating Power per Five Cubic Feet of Gas
No. 0	1.00	2.72	13.6	1.50	3.13	10.4
" 1	1.15	3.75	16.3	1.80	4.30	11.9
" 2	1.50	5.63	18.7	2.30	7.25	15.8
" 3	1.80	7.97	22.1	2.75	10.11	18.4
" 4	2.40	11.26	23 4	3.60	15.21	21.1
" 5	2.60	12.76	24.5	4.35	20.40	23.4
" 6	3.15	15.95	25.3	4.95	25.42	25.7
" 7	3.80	20.07	26.4	6.05	32.75	27.1
" 8	4.70	24.76	26.3	7.10	40.63	28.6

TABLE II.—*Extracted from British Association Tests*, 1880.
Burner used—"Special" Slit Union, with 16-candle gas.

Kind of Burner.	At 3-10ths Inch Pressure at Point of Ignition.			At 6-10ths Inch Pressure at Point of Ignition.			At 9-10ths Inch Pressure at Point of Ignition.		
	Cubic Feet of Gas per Hour.	Illuminating Power.	Illuminating Power per Five Cubic Feet of Gas	Cubic Feet of Gas per Hour.	Illuminating Power.	Illuminating Power per Five Cubic Feet of Gas	Cubic Feet of Gas per Hour.	Illuminating Power.	Illuminating Power per Five Cubic Feet of Gas
No. 4	3.2	8.0	12.5	4.8	13.6	14.2	6.4	17.8	13.9
" 5	3.2	8.2	12.8	5.1	14.2	13.9	7.0	19.5	13.9
" 6	3.5	8.8	12.6	5.7	16.0	14.0	7.8	21.6	13.8
" 7	3.9	10.6	13.6	6.4	18.4	14.4	8.8	25.0	14.8
" 9	4.8	13.2	13.8	7.9	25.2	15.9	10.8	34.5	16.0

TABLE III.
Burner used—Market Batswing, with 16-candle gas.

At 4-10ths Inch Pressure at Point of Ignition.			At 9-10ths Inch Pressure at point of Ignition.			At 1.3 Inches Pressure at Point of Ignition.		
Cubic Feet of Gas per Hour.	Illuminating Power.	Illuminating Power per Five Cubic Feet of Gas	Cubic Feet of Gas per Hour.	Illuminating Power.	Illuminating Power per Five Cubic Feet of Gas	Cubic Feet of Gas per Hour.	Illuminating Power.	Illuminating Power per Five Cubic Feet of Gas
5.8	17.8	15.3	9.8	32.2	15.6	13.6	45.0	16.5
6.2	19.3	15.6	10.3	33.5	16.2	14.1	48.0	17.0

Note.—The pressures in the original tables are higher than those here stated, but the stuffing in the burners reduces the pressure at the point of ignition to, as nearly as possible, those given above.

tant agent in producing the requisite thickness of flame, though no modification of pressure will remedy an initial defect in a burner. Guided by this "thickness of flame" principle in the construction of burners, and taking advantage of the thinning of flat flames and the thickening of Argand flames by pressure, it is possible to make burners consuming an equal quantity of gas to yield their highest lighting power with materially different pressures. As will be seen from Table III., flat-flame burners may be made to yield their best results with a high pressure at the point of ignition (which gives a firm flame) when required.

In the Argand burner the requisite thickness of flame may be and is obtained in several ways—viz., by using different diameters and numbers of holes for the emission of the gas; by varying the distance of the holes from each other; by increasing or diminishing the size of the air inlets, or of the chimney; thereby varying the speeds of the air columns, the lateral pressures of which exert an important influence on the thickness of the Argand flame.

Take a 5-feet Argand burner, retain the chimney and all the other parts unaltered, and reduce the consumption to one-half; and, as before stated, the amount of light yielded is reduced to less than one-third. How is it that with one-half the consumption there is less than one-third of the lighting power? This is due to the lessened power of the gas to resist the lateral pressure of the upward moving columns of air; consequently the flame is thinned, and its oxidation too rapidly effected. This result with the Argand may be altered, and the lighting power, for gas consumed, brought up to nearly 8 candles, by the simple expedient of lessening the thinning power of the air column by obstructing the air passages at the top of the chimney.

In the flat-flame burner the requisite thickness of flame may be obtained in several ways; but as the particular mode of doing this would be more appreciated by gas burner manufacturers than by an audience of gas managers, I need not mention it here, further than to say that the broad principle on which to work is to adjust the width of the slit in batswing and slit union burners, and to adjust the holes in the union jet burner so as to yield the requisite thickness of flame. Without entering into full particulars concerning the union jet burner, I may state, in passing, that there are difficulties connected with it when used for gas, say, below 20-candle power which interfere with the development of its lighting power, particularly in the smaller sizes. The larger sizes of union jets, and all the sizes of slit burners, present fewer practical difficulties, and they can be manipulated to give their highest or a medium lighting power as may be deemed best for the circumstances in which they are to be used. The principal circumstances to be considered are the amount of smoke that can be tolerated, and the atmospheric conditions—whether steady or agitated.

Having worked on the "thickness of flame" principle for years, I was prepared, when the electric light challenged attention in Paris, at the Exhibition of 1878, to meet it by an extension of the principle to flat-flame burners of higher lighting power. The diameters of slit burners then existing would not admit of a further development of their lighting power for gas consumed, as their gas consuming capacity could only be increased by further widening the slit, which, in the case of the larger sizes, was already too wide, and yielded too thick a flame for developing the lighting power of the gas. In order, therefore, to make burners of greatly enlarged capacity with a suitable width of slit, I had to construct burners with greatly enlarged diameters, across the top of which it was possible to cut a slit of the required width, whilst giving the burner the capacity to pass the increased quantity of gas. The lighting power of flat-flame burners was thus increased from 14.8 candles, the highest result previously recorded—calculated to 5 feet of 16-candle gas—to 17 candles. All my improvements in burners for cannel gas have been effected on this principle.

Before the discovery of the principle there were many instances of improvements in the lighting power of burners, both in my own experience and that of others, which could be cited as illustrations of it. My first experiments with gas burners in 1864 illustate it in a striking manner. They were conducted with a small union jet burner, and I found that by placing a piece of wire across the broad part of the flame, close to the burner, its lighting power was increased. In order to obtain this improvement in a practical form, I fixed a small piece of thin metal between the holes of a small union jet burner, and this had the desired effect. But I found that the ratio of increase of light gradually lessened as the sizes of the burners increased, until sizes were reached in which the piece of metal either ceased to afford any advantage, or became a disadvantage. That is to say, in the smaller sizes of burners, where the flame was much too thin to develop the lighting power of the gas, the piece of metal increased its thickness; but when applied to those sizes of burners in which the flame was thick enough for the quality of gas, the advantage of the flame-thickening piece of metal disappeared.

Thus, without then knowing anything of the principle enunciated, I was actually putting it into effect. This mode of increasing the lighting power of burners was afterward patented by another person, and has since been frequently revived as a novelty.

Another example is furnished in my double-flame burner, which gave the increased light in a more acceptable and striking manner than by placing the wire or the strip of metal in the flame. This burner, as you may be aware, consists of two small burners whose flames are brought together, so that they join immediately above the top of the burner. The result of this combination of the two thin flames is a large increase of light, owing to the thickening of the flame and the consequent retardation of combustion. At the time I patented this burner—viz., in 1865—I was under the impression that it was a novelty; but afterward found, to my consternation as a young inventor, that it had been anticipated. I ceased to manufacture it, on account of its many practical defects, foremost among which are its smokiness and looseness of flame when used below 8-10ths pressure. Notwithstanding its history and its defects, people continue to patent this burner, and some of them, by means of experimental tricks (well known to most gas managers, but unfortunately not to their customers), palm it upon the public as a new invention, and superior to all others.

A further illustration of the operation of this principle is afforded by the enlargement of the holes of the Argand burner, which took place some years ago, whereby the flame was thickened, and consequently, as I hold, the lighting power increased. But this increase of lighting power was attributed to the diminished pressure at the point of ignition, which would obviously take place. Hence, apparently, arose the theory applied indiscriminately to Argand and flat-flame burners, that to develop the lighting power of gas it must be consumed at the lowest possible pressure.

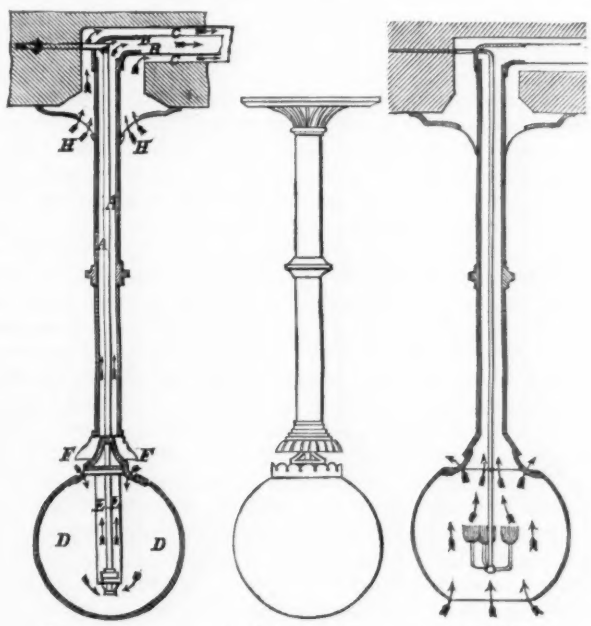

Fig. 1.—Section. Fig. 2.—Elevation. Fig. 3.—Section of Flat-Flame Ventilating Chandelier.

Argand Ventilating Chandelier.

Having thus set forth the principle on which, as I maintain, all developments of the lighting power of coal gas have been and must continue to be made, let us pass on to the consideration of the use of the improved burners. Their increased capacity and improved lighting power per foot of gas were attended by disadvantages arising from increased unsteadiness, and tendency to smoke. For many purposes these would have been fatal objections. To overcome this unsteadiness I determined, for street lighting, to support the flames by a regulated vertically moving column of air, similar to that employed in the Argand burner, but necessarily of much larger area; and this was obtained by the mode of top and bottom ventilation with which you will all be acquainted in my street lanterns. But this column of air, whilst steadying the flames, unduly thickened their edges on the under side, and gave them a tendency to smoke, to overcome which I placed a wing or projection immediately under each edge. But I came to the conclusion that the most efficient means for lessening the smoky tendency, increasing the brilliancy, and controlling the lighting power of the flames, would be to group them as shown in the accompanying engraving (fig. 3), in such a way that they would heat each other. This grouping of the flames had the further advantage that it enabled the number of the burners to be multiplied to any extent required, to compete with the fabulously stated power of the electric lights on their own sensational lines. Another advantage obtained by so grouping the flames is that it disperses, to a great extent, the shadows produced by the ribs of the lantern, by rendering a large portion of the flames visible on each side of each rib. By these means the use of large and improved flat-flame burners was rendered not only possible but highly advantageous.

It will have been gathered from what has already been stated that I had full confidence that the flat-flame system of lighting was the proper one by which to advance gas interests. It may therefore not be out of place that I should here briefly state, for future guidance, the advantages which the flat-flame burner possesses over any burner on the Argand principle. In the course of experiments with the latter burner, with the object of improving its lighting power, I became convinced that, for the trying conditions of every-day use, it was unsuitable, by reason of its sensitiveness to variations of pressure, its tendency to smoke with the slightest addition to the maximum quantity of gas it is constructed to consume, its rapidly diminishing yield of light (for the gas consumed) when burning less than its full quantity, the necessity for the use of a chimney, the rapidly diminishing yield of light by the dirtying of the chimney, and because the chimney becomes semi-opaque by use when it does not happen to break. In addition to all these defects, there is, when it has to burn gas of a high quality, the objection that it yields, even on the photometer, less light than the flat-flame burner. These defects, I feel sure, would all be developed to the utmost, when Argand burners were used for street lighting, and must be fatal to the system. History has confirmed this opinion. Another defect of the Argand burner is its lack of top and bottom light, as compared with the flat-flame burner. It has been stated before a Committee of the House of Commons, and in papers read before Gas Managers' Associations, that the Argand burner yields a light in all directions alike; which means that the side light shown on the photometer is the measure of its lighting power in all directions. A more inaccurate statement is scarcely conceivable. The error of the assertion can be easily ascertained by placing an Argand burner against a whitened wall, when it will be seen how much more powerful is the lateral than the top and bottom light.

Had time permitted I would have given you an account of a unique experiment, proving that the total all-round light yielded by a flat-flame burner with 5 feet of gas is at least equal to that yielded by an Argand with the same consumption. Want of time also compels me to defer, until another occasion, dealing with the many important questions that arise out of the principles I have been discussing.

I will now pass on to a consideration of some of the conditions to be fulfilled in order to secure effective street lighting. It is an essential feature that there should be an even distribution of light over the whole of the roadway. There should be no brightly lighted spots, with intervening patches of comparative darkness; for, in addition to their objectionable appearance, streets so lighted are unsafe, as both foot passengers and drivers of vehicles have their eyes so dazzled in passing over the excessively illuminated spots into the darkness immediately beyond, that an element of danger is thereby introduced into the streets. I also hold that the illumination of the upper parts of buildings, especially those that have balconies and similar projections, is necessary, in order to afford security to property, by giving the police the power of watching the upper as well as the ground floors. In this age of advancing taste, those interested in the progress of gas lighting can not afford to lose sight of that which is pleasing to the eye. To put the upper parts of buildings in darkness is to throw away one of the most effective applications of gas lighting. It is true that some of the structures in our principal streets do not call forth much admiration; but when we consider the splendid lines of buildings in most of the large towns of the United Kingdom—of which Princes Street, Edinburgh, affords so conspicuous an example—I think you will agree with me that to throw those imposing facades into darkness would be an act of unqualified vandalism. But there is the further and very important advantage that the illumination of the buildings materially assists, by reflection, in distributing the light over the roadway. The bright and cheerful aspect of streets so lighted contrasts most favorably with those in which the buildings are left in darkness, as the latter present overhead the oppressive appearance of a dark vault.

To attain the objects thus mentioned the light must be carefully manipulated. In my opinion, the only portion which could be regarded as wasted, if allowed to pass away, is that which passes vertically upward. The best way to deal with the upward vertical rays is to utilize them by means of a flat porcelain or other reflector, placed in the roof of the lantern, for the purpose of clearing from shadows the base of the pillar. The whole, or a large portion of the upward oblique rays should be allowed to pass through the roof and sides of the lantern, and reach the buildings. In order to admit of this the portion of the lantern roof not covered inside by the reflector must be made of clear or of white glass, and not of any opaque substance. Another important point is that the flames should be well below the waist of the lantern, so that when white glass tops are used some of the oblique rays may pass upward to the building through the clear side panes. If the flames be placed too high in the lantern, a too great concentration of the downward reflected rays takes place immediately around the base of the pillar.

The pillars usually employed in our streets, averaging from 9 feet to 10 feet in height, are too low to admit of an equable diffusion of light; and this defect is made more patent by the introduction of lanterns of large lighting power. For lanterns up to 100-candle power the columns should not be less than 10 feet high—12 feet would be better, but the public would probably object to the innovation. Lanterns of 80-candle power, placed on columns 12 feet high, light broad thoroughfares in an equable manner, and such an elevation would ultimately be accepted as an improvement.

For wide, open spaces, lanterns up to 1,100-candle power are now advantageously employed. These should be placed on columns from 16 feet to 24 feet high, according to their power. For lanterns of 400-candle power and upward, enameled iron or porcelain tops are suitable, as the great height of the lanterns from the ground and their distance from the buildings render clear or white glass tops unnecessary, and risk of breakage of the top panes, which at that height cannot readily be replaced, is entirely avoided. In these lanterns a flash jet must be used, as they are out of the reach of the pole of the lamplighter.

The modern demand for greatly improved lighting in the streets, of course, increases the expenditure on gas; but this is materially lessened by the use of the "double service" arrangement, which enables the consumption of gas to be reduced to that of an ordinary street lamp when the necessity for a strong light has ceased. This gives an advantage to gas lighting with which electric light companies have nothing to compare. It is well known that when there is more electric light than lighting authorities care to pay for, there is no middle course, and the lights must be extinguished.

Though great improvements have been made during recent years in interior gas fittings, our great difficulty still lies with the makers and fitters of gas lighting apparatus. They, as formerly, seek to gratify the taste of their customers in design, clearly, in most cases, without the knowledge requisite to guide them to the construction of fittings adapted to apply gas with efficiency and economy. How to get these well-intentioned people to study the present phase of gas lighting is a problem which I cannot here attempt to solve; but much can be done by gas managers exerting their influence against the use of unsuitable fittings. There is now the greater necessity for this, because our electric light friends are attacking us in our most vital part. They have had the acuteness to detect and to play upon our most telling defects—viz., the heating and vitiation of the atmosphere. This is a legitimate form of attack, and it touches a weakness on our side which the public eagerly magnify. But if it can be shown that the defec s named are not inherent in the system, and that gas lighting apparatus can also be made valuable ventilating apparatus, then an advantage will be secured for gas with which again the electric light has nothing to compare.

For the purpose of combining ventilation with gas lighting, ventilating chandeliers have been designed from time to time; but, so far as I am aware, these have always been employed in connection with the Argand burner, the defects of which have already been pointed out. To remove the disadvantages of the system owing to the use of the Argand burner (which disadvantages I consider have prevented its more general introduction), I determined to remove that burner, and to try and adapt the system to flat-flames. In this attempt my highest expectations have been realized.

For the introduction of the Argand ventilating chandelier, which has been in use for several years, I believe we are indebted to Mr. Benham. Its object is not to allow the heated products of combustion to pass into the atmosphere of the room, but to convey them direct from the burners into a chimney, or into the outer air. His apparatus is shown in section and elevation in figs. 1 and 2. A ventilating shaft A A, suspended from the ceiling, and turned by an elbow into the horizontal tube B B, passes between the ceiling of the room and the floor of the upper chamber into the chimney. The upper part of this shaft is surrounded by an outer tube C C, which also opens into the chimney. To the bottom of the suspended shaft is attached the large globe D D, and inside this globe is placed the Argand burner E E. The air for supporting combustion is admitted at the openings F F, descends between the sides of the globe and the burner, and then ascends the chimney of the burner. The products of combustion enter the ventilating shaft A A, and are thereby conducted into the chimney of the room. The outer tube C C is intended to ventilate the upper part of the room. When the burner is lighted the air in this outer tube is warmed by the heated air and gases passing through the inner shaft, and a draught is thereby induced into the chimney of the room. The air of the room passes through the openings H H to supply the place of the rarefied air, and is conducted into the chimney. In this way the room is kept free from the products of combustion, and its air is effectively but imperceptibly renewed.

I have before stated that it was to remove the objections connected with this system that I determined to try to adapt it for flat-flames, and for two years I have had such a modified form in successful operation in my own dining-room, and have supplied them to some of my friends. A section of this is shown in the annexed engraving (fig. 3). The alterations I have made are in the globes, the burners, and the diameter of the ventilating shaft. These were made with the view to secure the steadiness and brilliancy of the flames, whilst ensuring that the products of combustion should pass up the shaft and not into the room. For the latter purpose, when flat-flames are

employed, it is necessary to use a shaft with a diameter greater than that which is required when the Argand burner is employed, as the chimney of that burner conducts all the products directly into the ventilating shaft, whereas with flat-flames, though the heated products naturally keep to and ascend up the center of the globe, they are mixed with a large quantity of air, which necessitates a wider shaft. The interior of the shaft should not be less than 2 inches; but the usual sizes, when the Argand is used, are from 1¼ to 1½ inches. From the bend, the horizontal part of the shaft should be 3 inches in diameter, to afford a free flow for the outgoing products. The burners are arranged in a cluster on the principle which I first introduced in street lanterns. To secure the steadiness of the flames, I arrange for a column of air having a diameter considerably greater than that of the flames to pass through the globe, by making, in a 12-in. globe, a hole at the bottom 7 in. wide; and a suitable speed of air is obtained by making the top outlet of the globe of the same diameter as the bottom opening. The conical bottom of the shaft is 5 inches in diameter. These dimensions produce a column of air which is adapted to the flames when they are placed in or near the center of the globe. It will be perceived that a much greater volume of air is admitted at the bottom of the globe than can pass up the ventilating shaft; the portion of the air which does not come into contact with the flames passing through the annular space between the top of the globe and the bottom of the shaft, whilst the products of combustion, and the air brought into contact with the flames, are caught by the conical bottom of the shaft, up which they pass into the chimney.

As to the efficiency of this apparatus, I can state that it leaves scarcely anything to be desired. The whiteness and steadiness of the flames are so remarkable that people who are not familiar with the capabilities of gas, and who deemed that so admirable a result could only be yielded by the electric light, have frequently mistaken it for the new illuminant. The wide opening at the bottom of the globe, which is wholly unobstructed, allows the light to pass freely downward; and the ground glass globe, which I use in preference to either clear or opal glass, diffuses the light over the whole of the room, in a manner which cannot be equaled by the ordinary chandelier, with all its light-obstructing paraphernalia.

These improvements I have not attempted to secure by patent, nor have I time to enter upon the manufacture of the chandelier; but I shall be glad to give every assistance to manufacturers who may choose to take it up on their own account. I have pleasure in giving this public description of it, feeling sure that its general adoption, in place of the common chandelier, would greatly promote gas interests.

This paper has assumed larger proportions than I originally intended, and, had I written it before sending the title to the Secretary, the latter part would probably have given place to a somewhat more detailed exposition of the theory of the development of the lighting power of coal gas. But, under any circumstances, the latter field is too wide to be covered within the desirable compass of a paper to be discussed at this meeting; and I must defer the detailed consideration of many of the points touched upon, and their practical outgrowths, until another occasion. For the present my object has only been to open the subject. I have been assertive rather than argumentative in places; but I have endeavored to suggest the lines on which the experiments may be made, so that the correctness or otherwise of the theory may be demonstrated by any person who cares to go into the subject. I trust that what has been said will help to quicken the attention of those concerned with gas affairs, and will stimulate further inquiry and experiment.

[The author desires to add to his paper the following note:—Since reading this paper I have become aware that flat-flame burners have been employed by other persons in connection with a ventilating chandelier; but the burners and the globe are not arranged on the principles described above, and, in these and other particulars, that apparatus differs to an extent which I regard as vital, from the one which I have constructed.]

Discussion.

Mr. Romans wished to know whether the chandelier was moveable, or had a socket joint.

Mr. Bray replied that it was a fixture.

Mr. Thorns (Leeds), by permission, said he questioned whether Mr. Benham was the inventor of the ventilating shaft described in the paper.

Mr. Donaldson (Edinburgh) said that his firm (Messrs. W. and B. Cowan) had six of these chandeliers in their offices in Edinburgh, and they had been there for four or five years. He might also mention that Mr. Cowan had two of them fitted up in his drawing-room. A patent for such an arrangement could not therefore be taken out.

Mr. D. M. Nelson complained that the paper dealt with matter which was not new.

Mr. G. R. Hislop (Paisley) said he had listened with interest to the reading of Mr. Bray's paper. The matter was, he considered, of great practical value, and rules had been laid down which would guide them all in the selection of burners. Whether the tables were old or new, it was important that they should have their memories refreshed. The subject of proper burners for the consumption of gas of different qualities was one which ought to receive attention, and it could not be brought too frequently under notice. He admired the ventilating system described, and looked to its future with great hope and interest. It was the duty of every gas manager to introduce the system as largely as possible. One of the great objections to gas light had been the vitiation of the atmosphere of rooms; but the system then brought under the attention of the members seemed to him to be a complete method of obviating this objection.

Mr. McCrae (Dundee) said he could not allow the expression of opinion on the part of Mr. Nelson to pass as that of the meeting. Mr. Bray deserved the thanks of the Association for coming forward with this paper and explaining it so carefully and precisely as he had done.

Mr. D. Bruce Peebles thought Mr. Bray had devoted a great deal of attention and intelligence to the subject of gas burners, and he had all along looked upon him as the pioneer of men who had raised the business of gas burner supply above the status of the itinerant vendors who had done so much harm to burner making. There was no question that his burners might be depended upon to do what he professed he would do. He had always held the opinion that each size of burner was specially fitted for one particular quality of gas and one particular consumption, and these were the two points that no one should lose sight of. They had to deal with the question of the ordinary use of gas; and Mr. Bray had not given the best theoretical results, but burners suited for the work which he sent them out to do.

Mr. Bray, in reply, said he was very well satisfied with the manner in which his paper had been received. As to the person who originally introduced the ventilating apparatus, he had to say he had made inquiries, but had failed to obtain definite information. If Mr. Benham was not entitled to the honor, he should be glad to learn the name of the right person. He was rather pleased than otherwise to hear that Messrs. W. and B. Cowan had had in use for several years a similar apparatus to the one he described; and he was only sorry that he had not known the fact sooner.

Mr. Donaldson said he was surprised that Mr. Bray was not aware of the fact, because it had been advertised in the *Journal of Gas Lighting*, and a letter thereon had appeared in the *Journal* in 1879.

Mr. Bray—Fitted with flat-flame burners?

Mr. Donaldson—Yes.

Mr. Bray said he could still assert that he was glad to hear that the arrangement was already in the field, even though he was not the first. He should like to add that the tables were taken, as he had stated in his paper, simply to illustrate the principle. Whether old or new, they were authoritative statements of tests that had been made. But he did not rely upon these tables, or any he could produce, but upon an examination by gas managers of any tables that could be obtained; and he was certain they would illustrate the statement he had made. Beyond this he wished the members to make their own tests.

On the motion of the President, a vote of thanks was accorded to Mr Bray.

An Ancient Gas Engine.

The *Scientific American* of Oct. 7th contains the following concerning a gas engine which was illustrated and described in one of its numbers about 36 years ago:

In looking over an early volume of the *Scientific American*, we find in the issue of July 23, 1846, the following description of a gas engine which had just been invented, and which, the article says, might have been seen at the store of Samuel Perry, in Front street, near Whitehall, in this city. This was probably one of the earliest gas motors constructed:

"The machinery consists in part of a cylinder, piston, pitman, flywheel, and governor; in this respect similar to a steam engine. A small quantity of spirits of turpentine is kept in a warm state, and the vapor arising therefrom is mixed with fifty times its volume of atmospheric air. A small quantity of this hydrogenated air is drawn into the cylinder and ignited by a movement of the machinery, producing a slight explosion, whereby the remaining air—at least nine-tenths of the whole—becomes so heated that it drives forward the piston with great force. This engine is said to be capable of working ten horse powers, and it is intended to substitute rosin instead of turpentine, which will reduce the expense of feeding it to about 50 cents per day. The ingenious inventor has had some difficulties to encounter in the construction of the first engine, but has a fair prospect of being well remunerated for his labor."

A scheme for the amalgamation of the London Gas Company with the Gas Light and Coke Company has been lodged with the Board of Trade.

Electric Lighting at Troy, N. Y.

The Troy *Evening Standard* gives the following statement of the action of the Board of Aldermen of that city in relation to the proposition to light the streets by electricity—

At the meeting of the common council held Thursday, September 21st, Alderman Fox, of the Sixth ward, moved the adoption of a resolution allowing James O'Neill, Edward F. Murray, P. P. Connolly, Thomas Galvin, Thomas Farrell, John H. Gleason, and Michael Cavanaugh, the exclusive right to introduce and operate the electric light in this city and light the streets with the same. If even ordinary decency had prevailed among the Democratic members, or if any regard was had for the public weal, the resolution would have been referred to a committee, but when Alderman Geer moved the matter be investigated by the streets and alleys committee, his motion was lost—12 nays, 7 ayes.

The affirmative votes were cast by the ring democrats and voted away the biggest privilege ever granted by the city. More than this, an absolute monopoly was created, and a few aldermen by their own votes constituted themselves a party with unlimited power for the ultimate end of defrauding the city. The seven men named by Fox's resolution are mere dummies in the matter, and merely represent seven aldermen who have gone into a blind pool speculation, and by obtaining the electric light franchise sell it to the highest bidder.

The conspiracy it is said was first hatched in the fertile brain of Alderman Hopkins. The thing was all settled some time before the city fathers met, but at the last moment one of the aldermen backed out. Aldermen Fox and Hopkins then introduced the subject of electric light to Alderman Martin Murphy. "If we put through this resolution," said Hopkins, "we will get something nice, and if you vote for it you can become one of the shareholders."

"This is rather short notice," said Murphy.

"Well," broke in Fox, "your name need not appear in the matter at all. I'll put Johnnie Gleason's name in the resolution and he will represent you."

"All right," replied Murphy, "I guess Gleason will do the right thing by me."

Great minds run in great channels and the great minds of the electric light coterie of the common council run in a groove supposed to be lined with $50,000. It is not the purpose of the virtuous solons who contrived to pass the resolution for an electric franchise to establish for themselves a monopoly, but they propose to rob the city for their own gain by selling this gratuitous franchise to the highest bidder. The Albany electric light company, which illuminates with the Brush system, and the United States company of New York are both anxious to buy the franchise for a good round sum, providing, of course, that the aldermen guarantee a contract. The Albany company has purchased the exclusive right to operate the Brush system in Troy from the Brush company of New York city, and it is said has offered to pay $40,000 for the franchise recently granted to the seven virtuous citizens. The United States company will pay $50,000.

His honor, Mayor Grace of New York, recently wrote a letter to his honor, Mayor Murphy of Troy, asking him to use his best efforts to induce the city to use the United States light for illuminating the highways and byeways. The reason for Mayor Grace's solicitude is that he is one of the largest stockholders in the United States company. By his efforts in New York he succeeded in having the city contract with his company for the illumination of certain streets from Canal street to Union square. Of course Mayor Grace's letter to Mayor Murphy and the passage of the present electric light resolutions may be only coincidences, singular and striking, but the connection would seem to be as strong as that between sin and Satan.

In New York city the various companies own the lamps and lamp posts, and are paid seventy cents per night for each light. In Albany the city owns the lamps and lamp posts, having purchased them from the company for $125 each. The company is paid fifty cents for each light nightly. There are at present 325 lamps in the city, which are operated at a cost of $162 50 per night, or $59,312 50 per year. Troy has 666 gas lamps, which are illuminated for $14,000 per year. Leaving aside the cost of erecting electric light lamps and lamp posts, and computing only the actual running cost of the light in Troy, and estimating only for 250 lamps, the cost would be $125 a night, or $45,625 a year. More than triple the present outlay for illuminating the city.

As soon as the electric light conspirators make their bargain with the United States or Albany company it is expected that they will rush through a resolution in the common council directing the contracting board to advertise for bids to light the streets with electricity. The seven men named being the only persons having a valid right to lay electric light wires will be the only persons competent to bid, and naturally the contract will be let to them. They will then sublet it to one of the companies and thus defraud the city and enrich themselves.

Taxpayers will eagerly look for the mayor's action on this barefaced attempt to rob the city treasury for the benefit of a few men who are nothing more than cancers in the body of the people. The mayor need not veto the bill on any sentimental grounds, for if he consults his astute city attorney he will learn that it is against the statutes of the state to grant an exclusive privilege in any city to any company, not only because it is a monopoly, but because it acts as a bar to future progress.

Persons well informed assert the mayor is in a quandary. He has been given to understand plainly that if he defeats the pet scheme of the aldermanic coterie he need not expect their support for any of his favorites in the coming election. It is understood his honor wants the matter to rest until the campaign is finished, but the aldermen have greedy eyes on the golden egg, and there is likely to be trouble in the democratic camp.

No matter what final action may be taken by the mayor, the taxpayers should at once stamp their disapproval of this attempt to wring from them by force money to fill the pockets of political vultures. If this scheme should reap success for its originator it would be but the forerunner for others more stupendous, and all citizens who are interested in the prosperity of the city, and in decent government, should not only oppose the scheme, but relegate to well-merited retirement the representatives who made its success possible by their votes.

[From the "Review of Gas and Water Engineering."]

Some of the Advantages of the Dry Center Valves.

A paper read before the South West of England District Association of Gas Managers, by Mr. J. Lowe, of Weymouth.

The subject on which I venture to offer a few observations is "Some of the Advantages of the Dry Center Valve." At the outset I may remark that there are few provincial gas managers who have not, at one time or another, been troubled with some of the numerous inconveniences of defective valves. In his earlier days the writer, in common with others, had a few uncomfortable experiences with the old hydraulic valve in its varied forms, as well as with the ordinary slide-valves; but for the last 16 or 17 years he has almost entirely escaped them. This he attributes to the general adoption of the dry center-valve; he having used them in connection with exhausters, scrubbers, condensers, purifiers, station meters and gasholders.

The construction of the type of valve under consideration is, I presume, so well known that a detailed description is altogether unnecessary. Suffice it to say that it is made in three parts, which may be termed the body, the well, and the cover. The branches (*i.e.*, flanges, or sockets) being cast on the body on which the cover rotates, the faces of both are surfaced gas-tight, and the cover kept in its position by a center-pin secured with suitable lock-nuts. It is also fitted with pointers, which indicate at a glance the direction of the flow of the gas; and may also be provided with a locking arrangement to ensure its being turned to, and kept in, the position desired.

The valve is made in so many forms, and to effect such numerous changes, that to enumerate them would occupy too much of the limited time at our disposal; but, if I may presume to do so, I would venture to press upon the members of this Association the importance of having thoroughly reliable valves in the parts of the plant between the hydraulic main and the station meter. The inconvenience and perplexity caused by defective or unsound valves would be difficult to calculate, especially in connection with the purifying plant.

Slide valves, if sound at first, become defective from a variety of causes. An instance of this came under my own notice, in which two slide-valves were fixed between the inlets of the principal and the guard or lime purifiers—I presume for the purpose of throwing the large vessels out of use. These valves appear to have been perfectly sound for some time; one morning, however, to the consternation of the manager, foul gas was reported to be in the town. Testings were immediately made at the oxide purifiers and nothing but clean tests could be obtained, neither was the cause of the trouble discovered satisfactorily; consequently a watchful eye was kept upon the guard purifiers. The difficulty soon re-appeared, although a foul test could not be obtained at the inlet of the last oxide purifier. The manager having a narrow escape from delivering foul gas in the town a second time, the connection between the two slide-valves was severed, and the pipes blocked; and as far as I know, there has been no more difficulty in the direction indicated. Slide-valves are also expensive, especially when employed for purifier connections, as they require such a multiplicity of bends, branches, etc., besides the necessity of having two corner or outlet tubes instead of one to each vessel.

Every member of this Association will, I think, agree that simplicity in the arrangement of the plant should be the aim of every gas manager. The valve under consideration goes far toward accomplishing this desirable end. The crossing of pipes at various depths and providing syphons, which require constant watching, and which, in spite of the utmost attention, will, and do give trouble, may be entirely obviated. I know works where not a single syphon is to be found in the manufacturing plant; the valves being so arranged that the overflow of the whole of them runs to the tar well. The connect-

ing pipes are also of the simplest possible kind; thus, if employed for working two purifiers, two bye-pass valves will do all the work of six slide-valves, and with about one-fourth of the connections. All that is necessary to complete the connections is two simple connecting-pipes to each purifier. There is also much less risk of an accidental stoppage caused by closing the wrong valve, as the closing of one gas-way of the center-valve opens another; and instead of having to manipulate six valves—opening some and closing others—all that is required with the dry valve, in order to turn off the foul purifier, is to give one of the valves one quarter turn. When the vessel is emptied and re-charged, one quarter turn of the other valve will put it into action. The clean purifier being the last, similar changes will operate in like manner upon the other purifier.

While upon this part of the subject it may not be out of place to say that the system of working two purifiers with two bye-pass valves has some advantages even over the plan of working a set of four purifiers with one center valve—viz., instead of always having one-fourth, and in some cases one-third of the purifying power out of action, the whole is nearly constantly employed; the exception being that of the time occupied in emptying and refilling one purifier. The comfort of having purifiers of large area, and the economy of working, cannot be easily estimated. In my own experience, a change from four vessels 8 feet by 8 feet, to two 16 feet by 12 feet, was to turn days into weeks as regards changing purifiers. It by no means follows that the branches should be at right angles; they may be cast at any angle to work in the line of existing pipes, by the manager making himself acquainted with the construction of the valve, and giving ordinary care to the preparation of his drawings. It may be safely stated that for the same amount expended upon two large purifiers, the purifying power would be threefold as compared with four purifiers of smaller dimensions having one center valve. If I were laying down a set of four purifiers I should seriously entertain the employment of six simple bye-pass valves in preference to one center-valve or twelve or fourteen slide-valves, thus using the plant to the fullest extent.

The dry center-valve is practically indestructible. The seatings or wearing parts being always covered, the gas cannot act upon them, neither can dirt or grit be carried and deposited in recessed seatings. There being no springs, stuffing-boxes, or delicate mechanism, skilled labor is not required to keep them in order; repairs there never need be. The men ordinarily employed on the works can, under the supervision of the manager, do all that is required to keep them in perfect working condition for years. The only attention I ever found necessary was an annual overhaul, the covers being lifted, and the faces cleaned and oiled, which when off gives facilities for flushing or cleaning the connections.

I will simply add that the last valve I removed (an eight inch one for four purifiers) had been in use rather more than ten years, and previous to its leaving the works I was curious enough to have the cover removed to examine the faces, which proved to be in perfect condition; in fact, as good as when first fixed.

DISCUSSION.

Mr. Geo. Garnett (Ryde) had no hesitation in saying a word or two on the subject of the paper, having used the dry center valve for the last 16 years. He thought that the great weight of iron in the valve has not always been taken sufficiently into consideration, and it was most important that the valve should be placed upon a good firm foundation. His first valve was not put upon a good foundation, and gave some trouble in consequence, so when a short time since he was fitting in another, he took care that this point should receive attention. He supported the suggestion to give the valve an annual inspection and he found it a good thing at these inspections to put a small quantity of emery on the face and to give the valve several turns, so as to form a new surface. But he did not go to the extent recommended by the reader of the paper for there were many situations in which the slide valve might be used, and indeed was preferable. He had seven dry surface valves at his works, all 12 inch with one exception, a 10 inch center valve, but from the inlet and outlet of gasholders he advocated simple slide valves. Taking it altogether he thoroughly endorsed the remark that things should be used in a proper way, and under proper circumstances, for if care was not taken in this respect some trouble or other would follow. He did not believe in the hydraulic valve because the water in it became saturated with sulphuretted hydrogen and other impurities. He had supported the use of the dry center valve for 35 years, for that period had elapsed since he first saw a valve of this kind at Peter street, Westminster; but the valve he saw at that time was not at all comparable with the modern ones. He certainly endorsed the point advanced by the reader of the paper, while submitting that under some circumstances the slide valve might be preferable.

Mr. T. W. R. White (Sherborne) did not quite catch to what cause Mr. Lowe attributed the foulness of the gas in the case he had mentioned. He had nine of the valves in use at his works, and with satisfactory results. With regard to their use for gasholders, he thought the drip wells should have deeper seals than was at present the practice; for he had two gasholders, one of which gave considerably more pressure than the other, and he sometimes found that the heavier holder would force the seals in the valve, and so cause a passage of gas from the heavier to the lighter holder.

Mr. Garnett would prefer one dry center valve for the inlet and one for the outlet of the holder; but he should like to have a bye-pass pipe fitted with a slide valve between the two valves so that if any trouble arose from naphthaline, or if either of the holder pipes started leaking, he might pass the gas direct from the inlet to the outlet valve. For the purifiers he regarded the dry center valve as perfect.

Mr. T. Hardick (Salisbury) hoped that the day was past when it was necessary to advocate the claims of the dry center valve, which had been successfully used for many years. No difficulty could arise in working it.

Mr. A. Edwards (Taunton) quite agreed as to the importance of giving the valve a good foundation, and he thought it was not prudent to allow it to go more than six months without thoroughly cleaning the faces so as to make them perfectly tight, an operation which occupied seven or eight hours. It was very awkward if in the middle of winter a leakage occurred through the valve from one purifier to another, and therefore he strongly recommended examining the valves every six months. He had tried to make his valves go a year without attention, and had the foul gas into his last purifier as a consequence.

A Member—There are good dry surface valves and bad ones, and much depends upon which kind you use.

The President felt himself too much interested in the subject to be able to say anything about it. He would merely remark that Mr. Fiddes, of Bristol, who was a good authority, after using these valves for 17 or 18 years, had ordered as many as 8 or 10 of them; which proved that the experience of that gentleman was in their favor.

Mr. Lowe, in replying, said that Mr. Garnett had referred to the importance of a good foundation and he quite agreed, having found it always advisable after the valve was fixed and all the joints set up, to regrind the faces before setting the valve to work. It was also necessary that the surfaces should be kept clean, and if a little No. O. emery was used occasionally it saved a great deal of time and trouble. He thought he had made the cause of the trouble from foul gas clear in his paper. It arose from a slight defect in one of the slide valves with which his purifiers were bye-passed at the time; from no very obvious reason. With regard to the remarks made by Mr. Edwards, he found that once a year was quite often enough to clean his valves, and was able to do them all, all round the works, in one long summer day.

A Gas Driven Refrigerator.

London *Iron* contains the following—

Cold produced by the compression and subsequent expansion of air is now, and for some time past has been in extensive use for bringing frozen meat from the Antipodes, and for carrying the same across the Atlantic, the first machine for this purpose having been constructed by the Bell-Coleman Mechanical Refrigeration Company, of London and Glasgow. These machines are driven by steam cylinders, which form a portion of the machine, the steam being supplied in the usual way by steam boilers. Another way of driving these machines has been used in practice, viz., connecting them by means of a pulley or belt, with shafting put in motion by steam or gas engines.

These methods, however, are not suited for refrigeration on a small scale, such as for hotels, and the fish, poultry or meat stores of dealers, so that the possibility of constructing some simple arrangement by which the machine can be set in motion by means of a gas motor, without the intervention of gearing, has been the subject of much consideration by the above firm; and Mr. Coleman has recently taken out a patent by which the object has been successfully accomplished, by combining cylinders for the compression and expansion of air, together with a gas motor cylinder on one bedplate. The gas cylinder adopted is the Otto, Messrs. Crossley Brothers having co-operated with Mr. Coleman in bringing out this self-contained direct-acting apparatus.

The first of these machines has been put down on the premises of Messrs. G. F. Brooke and Co., of Old Leadenhall Market, where we had an opportunity of inspecting its working. Messrs. Brooke have recently had new premises constructed in the market, in which a suitable place has been found for placing the refrigerator, and connecting it with a chamber of 3000 cubic feet capacity, the walls being insulated so as to prevent the external heat penetrating into the chamber. The machine runs at a speed of about 140 to 160 revolutions per minute, discharging air at about 40 degrees below zero in a constant current at the rate of about 5000 cubic feet per hour.

This quantity of cold air is first sent into a portion of the chamber, divided off so as to form a freezing department in which game or fowls can be frozen for transmission to Paris or other foreign parts. The rest of the chamber is kept at about 40 degrees by the machine working twelve hours a day. If the machine is kept working longer the whole chamber can be kept at about the

freezing point. The arrangements for cooling and drying the compressed air are placed in the bed-plate, so that the machine is remarkably neat and compact, and stands in a space of about 12 feet long and 4 feet wide. The results of the working test were in every respect satisfactory, and point to the usefulness of the machine wherever refrigeration on a comparatively small scale is desired.

The Edison System.

The letter from a Washington correspondent which appeared in our columns of October 2d (p. 164) seems to have excited considerable interest as to the present status of the Edison system in New York city. It has also furnished the distinguished inventor an opportunity of explaining to the readers of the New York *Daily Tribune*, and other daily papers, what the proprietors of this paper are obliged to publish. If this statement is as accurate as some others which are credited to Mr. Edison, it can simply pass for what it is worth. About newspaper notoriety being a cause for fear, we can safely say that Mr. Edison never has shown the slightest alarm at its terrors. And about the matter of gas stock holders being so much "down in the dumps," perhaps some bold holders of stock in the original Edison concern, who bought at $2,500 per share, will tell how it is that this same stock can now be purchased for $600 a share. If, at any time, Mr. Edison should see fit we will be much pleased to have him contribute to our columns a full, clear, and complete statement concerning what he has done in the field of artificial lighting, with the cost thereof, including a fair return upon the money invested; thus we shall be able to give to our readers an authoritative statement that should be satisfactory to Mr. Edison, at least.

The newspaper extracts which follow explain themselves—

[From the New York "Daily Tribune."]

"It was stated yesterday that Thomas A. Edison, the inventor, had met with a great disappointment in the failure of his electric light apparatus to supply as many lights as he had expected it to do. The statement originated in a letter written to the American Gas Light Journal. A *Tribune* reporter called at the central office of the Edison Electric Light Company, and found Mr. Edison busy at his desk. 'Has the generator at the central station down-town failed to supply the number of lights which it was expected to?' asked the reporter.

"'Oh, you've seen that gaslight paragraph, too, have you?' replied Mr. Edison, laughing. 'Well, now, we began operations by furnishing 1,600 lights, and that is exactly the number we are furnishing now.'

"Did you expect to furnish more than that?'

"'Not until we had completed certain additions to our engine; and when they are completed, we shall furnish more.'

"What about the street mains?

"'Why, we've never had any trouble at all. Any statement that we have had such trouble is absolutely false and without basis. These stories have been printed in a journal that has to publish what will please the holders of gas stocks; but they will not be pleased at having any daily paper take notice of their utterances, because that gives us publicity of a kind which they do not like. The fact is that our success is such as to alarm holders of gas stocks. We have had no trouble of any kind with our apparatus.'

"At the central power-station of the company, in Pearl street, it was stated by the superintendent that no trouble had been experienced with the street mains or with the engines. The number of lights now in operation was said to be 1,600. As soon as the additions to the engine had been made, a greater number of lights would be furnished. The superintendent of the company said that the system of underground conductors was one of the most successful parts of the company's work. The mains were put down in lengths of twenty feet, and each length was subjected at the factory to a test of resistance. The loss of current in conductors extending fourteen miles was theoretically estimated at less than one two-hundredth of one horse-power. At this rate, if the whole of Manhattan Island were lighted through mains such as are now used, the loss by leakage would not amount to current enough to run one lamp. All persons connected with the company whom the reporter saw denied emphatically that they had met with any kind of check or disappointment in their operations."

[From the New York "Sun."]

"Touching the Edison incandescent light, we have received the subjoined communication:

"'To the Editor of the *Sun*—Sir: The statement copied from the American Gas Light Journal, which appeared in your Saturday edition, in which the statement is made that my system of underground conductors was a failure, and that I had been greatly disappointed, is absolutely untrue, just the opposite being the truth, as any one may easily ascertain, the system being in daily use. "'Thomas A. Edison.

"'October 7.'"

"In order that the value of this denial may be properly estimated, we reprint what we copied from the Gas Light Journal—

"'His information was derived from an electrician just returned from New York, who, as I understand, was summoned to your city for consultation on the subject. My informant states that Mr. Edison has just met with the greatest disappointment of his life—the complete failure of his attempt to light 2,500 houses with his incandescent lamps by his underground system of wires; but fifty houses could be lighted, the electricity being carried away owing to imperfect insulation. As the insulation was supposed to be perfect the conclusion is that underground conductors cannot be made to work.'"

"It seems to us that Mr. Edison should be more explicit, and not throw the burden on the public of ascertaining the facts. Does or does not his underground system suffice to light 2,500 houses? Does it at present light more than fifty houses? And was or was not an electrician summoned to New York for consulation on the subject? That the system is in daily use, and that Mr. Edison was not greatly disappointed are entirely consistent with the conclusion that his underground conductors cannot be made to do the work laid out for them."

October Quotations of Leading New York Gas Stocks for the Past Five Years.

The following were the bid and asked prices for the five leading New York city gas stocks, on the date of October 2d, in the five years commencing with 1878, as compiled from our files—

	Bid.	Asked.
October 2d, 1878.		
Manhattan	165	175
Municipal	95	98
Metropolitan	125	135
New York	75	85
Harlem	40	50
October 2d, 1879.		
Manhattan	140	145
Municipal	115	120
Metropolitan	115	120
New York	87	92
Harlem	40	45
October 2d, 1880.		
Manhattan	178	183
Municipal	165	175
Metropolitan	130	137
New York	104	106
Harlem	70	75
October 2d, 1881.		
Manhattan	210	215
Municipal	187	190
Metropolitan	150	153
New York	105	106
Harlem	90	95
October 2d, 1882.		
Manhattan	220	223
Municipal	180	187
Metropolitan	175	178
New York	117	120
Harlem	97	100

Exhibition of Gas and Electricity at the Crystal Palace.

The exhibition will be opened on the 24th of October, and great preparations are being made for the display. A feature of the exhibition will be the appearance of a large number of electricians who had not been heard of at the former electrical exhibits. Some of those prominent in the last display will repeat their show in new shapes, among whom may be mentioned the British Electric Light Company, who will illuminate the Egyptian Court; the Pilsen-Joel and General Electric Light Company, who will take charge of the Renaissance and Byzantine Courts; Messrs. Girard & Company will occupy a portion of the great transept; and Messrs. Strode & Company will be located in the northern nave. Mr. Werdermann, a new exhibitor, is placed in Alhambra Court.

The gas part of the display is in competent hands, and will be well represented, as will be guaranteed by the fact that Mr. George Livesey is chairman of the committee having this part of the affair in charge. The gas interest has been assigned the south nave, and every opportunity will be given to secure complete representation of the various systems of burners. One of the most interesting features will be a complete display of gas heating and cooking stoves.

The Secretary of the San Francisco Gas Light Company announces that the price of gas is to be reduced to $2 per thousand cubic feet. This is the cheapest rate ever made by this company.

THE AMERICAN
GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

Editor—G. WARREN DRESSER.
Manager—C. E. SANDERSON.

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Germany—B. WESTERMANN & Co., of New York

MONDAY, OCTOBER 16, 1882.

Patents.

359,413. Gas locomotor for vehicles.—J. M. A. Montclair.
259,549. Gas machine.—C. M. Kemp.
259,723. Process of and apparatus for producing illuminating and heating gas.—H. C. Shields.
259,736. Gas engine.—H. Wiedling.
259,881. Apparatus for burning illuminating gas.—P. W. Mackenzie.
259,952. Gas generating furnace for heating retorts.—A. Weber.
259,977. Gas purifying apparatus.—S. and J. Chandler.
260,038. Gas regulator.—L. H. McCullough.
259,039. Gas regulator.—L. H. McCullough.
260,513. Gas motor engine.—W. H. Wigmore.
260,587 Gas engine.—A. P. Massey.
260,620. Gas engine.—C. M. Sombart.
260,712. Gas apparatus.—R. H. Smith.
260,746. Gas burner.—E. B. Denny.
260,804. Electric gas lighting apparatus.—J. P. Tirrell.
260,805. Electric gas lighting apparatus.—J. P. Tirrell.
260,806. Automatic gas lighting apparatus.—J. P. Tirrell.
260,888. Gas burner for heating purposes.—J. Musgrave.
260,954. Process of and apparatus for manufacturing gas.—J. Dixon.
260,972. Gas bracket and cock.—C. H. Goodrich.
261,011. Gas machine.—C. Matthews.
261,043. Electric gas lighter.—T. H. Rhodes.
261,507. Apparatus for the manufacture of illuminating gas.—A. Wittamer.
261,551. Rotary gas scrubber or washer.—C. W. Isbell.
261,640. Gas regulator for vulcanizers.—J. A. Straight.
261,677. Apparatus for lighting gas by electricity. C. L. Clarke.
261,698. Process of manufacturing gas.—T. B. Fogarty.
262,260. Apparatus for lighting gas by electricity. J. P. Tirrell.
263,255. Burner for gas fires.—B. Verity.
263,307. Process of and apparatus for generating high pressure gas.—W. F. Browne.
263,308. Process of and apparatus for manufacturing heating, illuminating, and motive power gas.—W. F. Browne.
263,313. Generating gaseous vapors.—Wm. F. Browne.
263,315. Apparatus for generating and distributing high pressure gas.—W. F. Browne.
263,457. Electric gas lighting apparatus.—O. S. Armstrong.
263,611. Process of and apparatus for the manufacture of gas.—T. G. Springer.
263,612. Process of and apparatus for the manufacture of gas.—T. G. Springer.
263,921. Apparatus for generating gas.—N. M. Langdon.
263,984. Process of and apparatus for the manufacture of gas.—T. G. Springer.
263,985. Process of and apparatus for the manufacture of Gas.—T. G. Springer.
264,126. Gas engine.—C. G. Beechey.
264,320. Automatic cut-off for gas burners.—G. W. Metcalfe.
264,359. Process of and apparatus for supplying and measuring a heating and an illuminating gas from one main.—T. G. Springer.
264,453. Gas burner device.—F. W. Gordon.
264,640. Gas refining and steam power apparatus. B. W. Dunklee.
264,801. Utilization of by-products in the manufacture of coal gas.—R. W. Wallace.

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
(with W B Scott & Co.,)
34 PINE STREET, NEW YORK CITY.

OCTOBER 16, 1882.

☞ All communciations will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid.	Asked
Gas Co.'s of N. Y. City.				
Central	$466,000	50	75	85
Harlem	1,800,000	50	97	100
" Bonds	170,000			103
Manhattan	4,000,000	50	220	223
Metropolitan	2,500,000	100	175	178
" Bonds	658,000	..	105	108
Mutual	5,000,000	100	103	106
" Bonds				
Municipal	1,500,000	100	180	187
" Bonds	750,000		106	110
New York	4,000,000	100	117	120
Northern	270,000	50	—	100
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	102	105
Citizens	1,200,000	20	68	70
" S. F. Bonds.	320,000	1000	105	107
Fulton Municipal	3,600,000	100	75	80
Peoples	1,000,000	10	40	45
" Bonds	290,000	.	104	107
" "	250,000	...	78	90
Metropolitan	1,000,000	100	70	—
Nassau	1,000,000	25	55	60
" Ctfs.	700,000	1000	93	96
Williamsburgh	1,000,000	50	57	60
" Bonds	1,000,000	...	100	101
Richmond Co., S. I.	300,000	50	70	75
" Bonds	40,000	—	—	—
Out of Town Gas Companies.				
Buffalo Mutual, N.Y	750,000	100	—	75
" Bonds	200,000	1000	95	100
Citizens, Newark	918,000	50	—	—
" " Bds.	124,000	—	105	10
Chicago Gas Co., Ills			125	—
Cincinnati G. & C. Co.			178	180
Consolidated, Balt.			42	43
Bonds			107	—
East Boston, Mass	220,000	25	122	128
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	140	144
Halifax N. S	400,000	40	148	150
Hamilton, Ontario	350,000	40	117½	
Jersey City	750,000	20	155	160
Jacksonville, Ill	120,000	50	100	...
Lewistown Maine	400,000	100	—	100
Laclede St Louis Mo	1,200,000	100	117	—
Montreal, Canada	2,000,000	100	186	187
New Haven, Conn		25	132	—
Oakland, Cal			32	33
Peoples, Jersey City		...	75	80
" " Bds.			...	...
Pittsfield, Mass			120	130
Rochester, N. Y		50	70	80
Wilmington, Del		50	174	...
Yonkers		50	30	32
St. Louis Missouri	600,000	50	250	254
San Francisco Gas Co., S. Fr'isco Cal.			68	69
Toledo, Ohio			95	97
Troy, Citizens	600,000	100	—	—
Washington, D. C	1,500,000	20	215	220
" Scrip	375,000	15	245	250

Advertisers Index.

	Page
GAS ENGINEERS.	
William Farmer, New York City	198
G. Warren Dresser New York City	190
GAS WORKS APPARATUS AND CONSTRUCTION.	
James R. Floyd, New York City	195
T. F. Rowland, Greenpoint, L. I	195
Deily & Fowler, Phila., Pa	195
Kerr Murray Mfg. Co., Fort Wayne, Ind	195
Stacey Mfg. Co., Cincinnati, Ohio	195
Bartlett, Hayward & Co., Baltimore, Md	195
P. Munzinger, Phila., Pa	195
Morris, Tasker & Co., Limited, Phila., Pa	195
Davis & Farnum Mfg. Co., Waltham, Mass	166
GAS AND WATER PIPES.	
A. H. McNeal, Burlington, N. J	194
Gloucester Iron Works, Phila., Pa	194
James Marshall & Co., Pittsburgh, Pa	194
R. D. Wood & Co., Phila., Pa	194
Warren Foundry and Machine Co., Phillipsburgh, N. J	194
Mellert Foundry and Machine Co., Reading, Pa	194
SCRUBBERS AND CONDENSERS.	
G. Shepard Page, New York City	196
Jas. R. Smedberg, New York City	192
RETORTS AND FIRE BRICK.	
J. H. Gautier & Co., Jersey City, N. J	192
B. Kreischer & Sons, New York City	192
Adam Weber, New York City	192
Laclede Fire Brick Works, St. Louis, Mo	192
Brooklyn Retort and Fire Brick Works, Brooklyn, N. Y	192
Borgner & O'Brien, Phila., Pa	192
Gardner Brothers, Pittsburgh, Pa	192
Henry Maurer, New York City	192
Evens & Howard, St. Louis, Mo	192
Chicago Retort and Fire Brick Works, Chicago, Ills	192
Taylor and Anderson, Cincinnati, Ohio	192
DIETERICH'S REGENERATOR FURNACE.	
Charles F. Dieterich, Baltimore, Md	200
GAS METERS.	
Harris, Griffin & Co., Phila., Pa	198
American Meter Co., New York and Philadelphia	199
The Goodwin Gas Stove and Meter Co., Phila. Pa	199
Helme & McIlhenny, Phila., Pa	199
Maryland Meter and Mfg. Co., Baltimore, Md	198
GAS STOVES.	
American Meter Co., New York and Philadelphia	191
VALVES.	
Ludlow Valve Manufacturing Co., Troy, N. Y	197

EXHAUSTERS.

P H. & F. M. Roots, Connersville, Ind..... 198
Smith & Sayre Manufacturing Co., New York City..... 198

GAS COALS.

Penn Gas Coal Co., Phila., Pa..... 197
Perkins & Co., New York City..... 196
Cannelton Coal Co., New York and Philadelphia..... 197
New York and Cleveland Gas Coal Co., Pittsburgh, Pa..... 197
Newburgh Orrel Coal Co., Baltimore, Md 197
Despard Coal Co., Baltimore, Md..... 197
Fort Pitt Gas Coal, Pittsburgh, Pa..... 196
Chesapeake and Ohio R.R Coal Agency, N. Y. City..... 197

GAS ENGINES.

Schleicher, Schumm & Co., Phila., Pa..... 200

STREET LAMPS.

J. G. Miner, Morrisania, New York City..... 166

PURIFIER SCREENS.

George D. Cabot, Lawrence, Mass..... 190

BURNERS.

G. Gefrorer, Phila., Pa..... 194
The Goodwin Gas Stove and Moter Co., Philadelphia, Pa. .. 176

PURIFYING MATERIAL.

Connelly & Co., New York City 198

STEAM BLOWER FOR BURNING BREESE.

H. E. Parson, New York City..... 190

PROCESSES.

Gwynne Harris New York City 194
Strong Gas and Fuel Co., Yonkers, N. Y..... 190

GAS FIXTURES.

Mitchell, Vance & Co., New York City..... 198

CEMENT.

F. O. Norton, New York City 198

BOOKS.

Economy of Gas as a Fuel..... 196
Gas Analyst's Manual 197
Scientific Books..... 194
Cathels' Gas Consumers' Manual..... 199
Fodell's Book-Keeping..... 199
Review of Gas and Water Engineering 199

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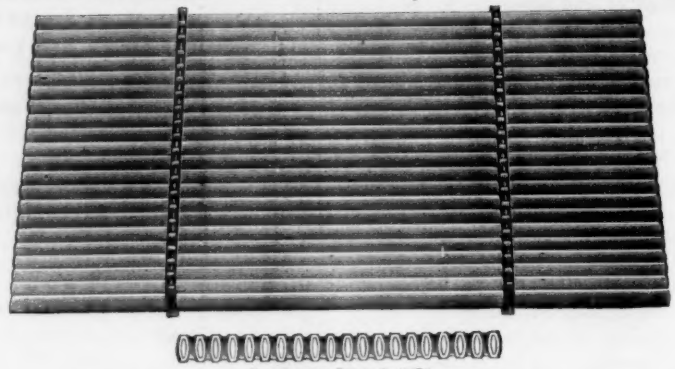

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References:—Lawrence Gas Co. Lawrence Mass., Roxbury Gas Co., Roxbury, Mass.; Newport Gas Co., Newport, R. I.

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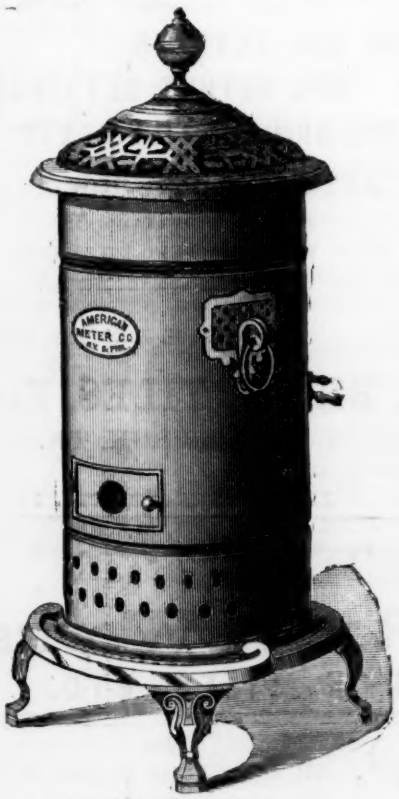

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Reno,	Hannibal,	Newark, O.,
Petaluma,	Red Bluff,	Louisville,
Indianapolis,	Oakland,	Salt Lake City.
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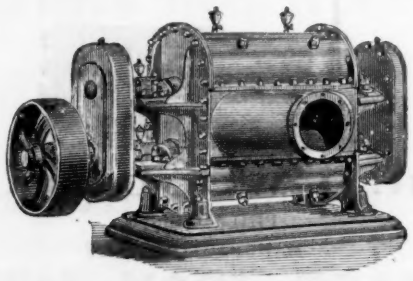

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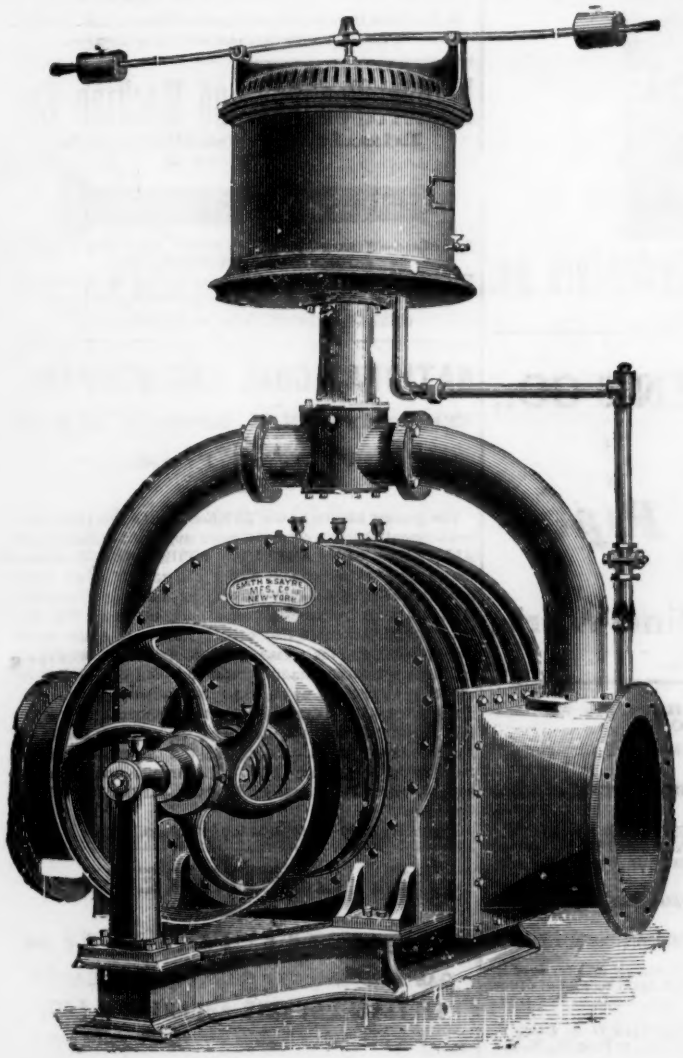

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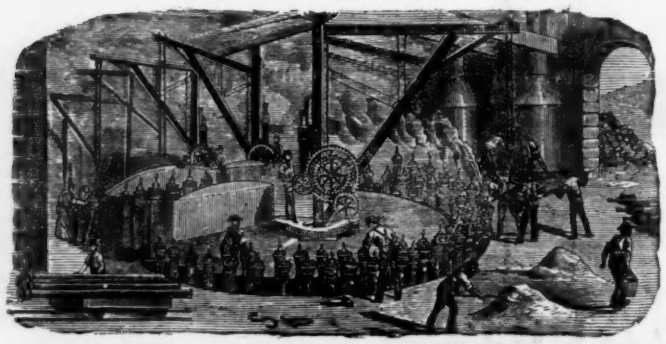

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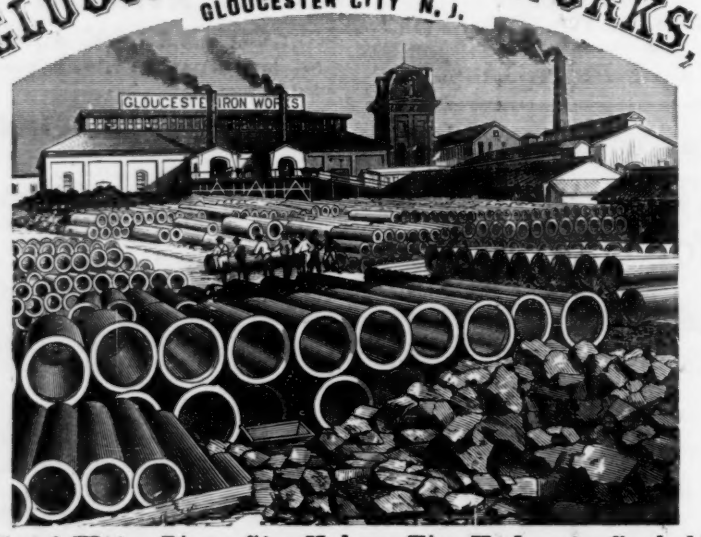

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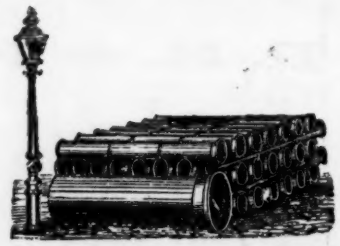

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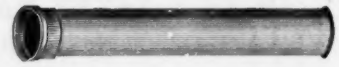

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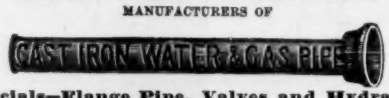

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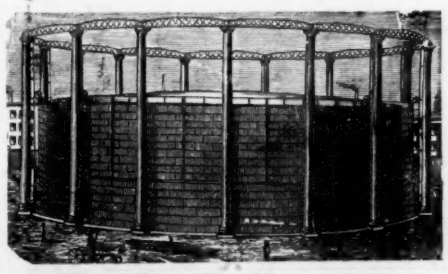

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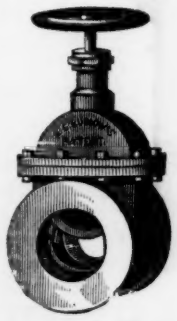

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APPENDIX.—Rules and tables to facilitate the calculations necessary in the determination of the illuminating value and degree of purity of coal gas. Photometry. Ammonia and sulphur. Proving of testing meters in London. The gas referees' cubic-foot measure. Times and mode of testing for pressure in London. Proposed standards of light.

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Attest—J. L. CAMPBELL, Secretary, pro-tem. Signed—A. T. GOSHORN, Director General J. R. HAWLEY, President

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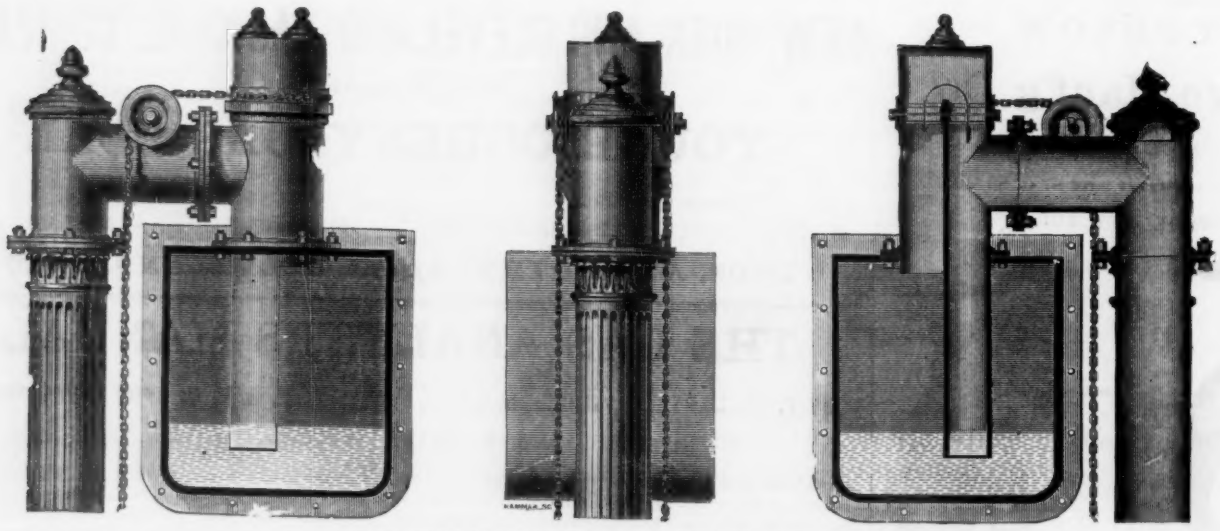

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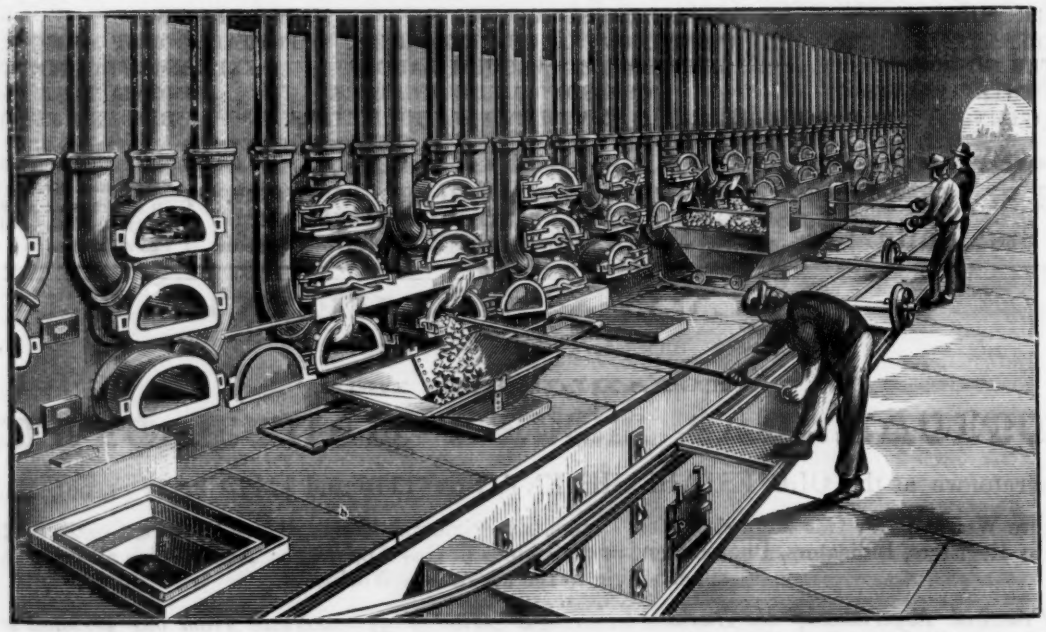

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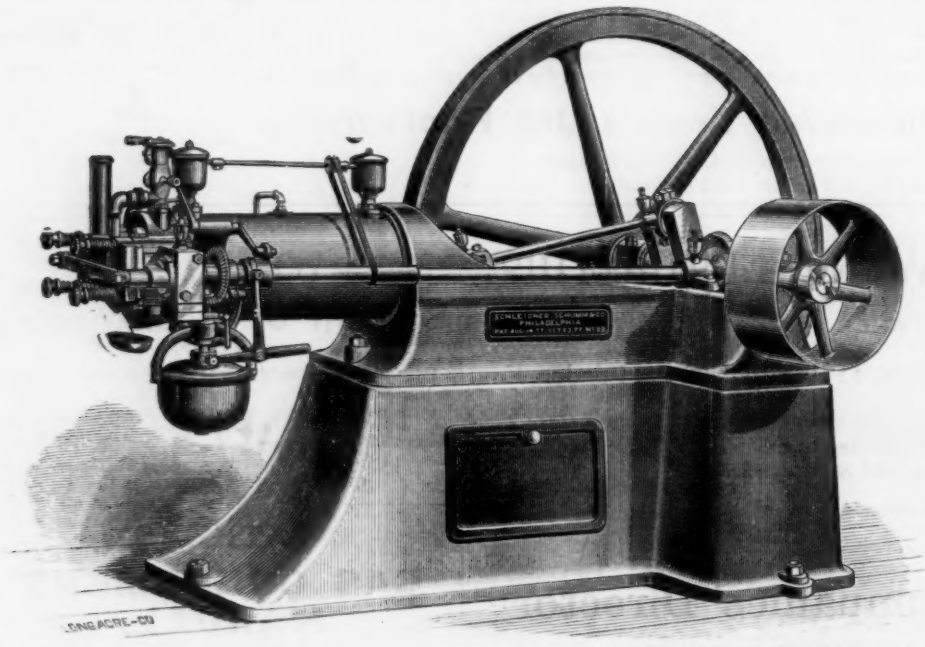

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